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Third Quarterly Circular for 1940.

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Rubber Research Scheme (Ceylon)

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DARTONFIELD ESTATE—VISITORS' DAYS

The *second* and *fourth* Wednesdays in each month have been set aside as Visitors' Days at Dartonfield estate, and the services of technical officers will be available to visitors on those days. The estate superintendent will be available every Wednesday. Visitors are requested to arrive on the estate not later than 9.30 a.m.

While visitors will be welcomed at the Station on other days, any particular member of the staff may not be free to give them attention unless an appointment has been made.

Dartonfield estate is situated about $3\frac{1}{2}$ miles from the main Matugama-Agalawatta Road, the turn-off being near culvert No. 14/10. The distance from Colombo is approximately 47 miles.

PUBLICATIONS

Rubber Research Scheme publications comprising Annual Reports, Quarterly Circulars and occasional Bulletins and Leaflets are available without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of Rubber estates in Ceylon over 10 acres in extent. Application for registration should be made to the Director, stating the name, acreage, and registered number of the estate(s) concerned.

ADVISORY CIRCULARS

The former issue of cyclo-styled Planting Memoranda have been replaced by printed Advisory Circulars. The undernoted Circulars may be obtained on application at 25 cents per copy. Future issues in the series will be sent free of charge to estates registered for the receipt of our publications :—

(1) Notes on budgrafting procedure.

(2) Programme of manuring for replanted rubber clearings (May, 1940).

(3) Notes on rubber seedling nurseries (November, 1939).
(4) Contour lining, holing and filling, cutting of platforms, trenches and drains (June, 1939).
(5) Straining box for latex (January, 1940).
(6) Notes on the care of budded trees of clone Tjirandji 1 with special reference to wind damage (September, 1938).
(7) Notes on procedure and equipment at Dartonfield Estate factory (May, 1940).
(8) Planting and after-care of budded stumps (January, 1940).
(9) The preparation of latex for shipment (May, 1940).
(10) Root disease in replanted areas (August, 1939).
(11) Emergency rubber coagulants (May, 1940).
(12) Warm air drying house for crepe rubber (May, 1940).
(13) Notes on the preparation of clean rubber (May, 1940).
(14) Rat Control (September, 1940).

PACKING RAW RUBBER

We understand that the attention of rubber dealers and shippers has been drawn to the British Government's request that the use of plywood chests for packing rubber should be discontinued. This request results, of course, from the Government's general policy of conserving foreign exchange by limiting the purchase of non-essential goods from countries outside the British Empire. The recommended alternative form of packing is the hessian-covered bale.

The packing of rubber in bales is already practised on a large scale by several of the main Colombo shippers, but a not inconsiderable volume of Ceylon rubber is prepared for shipment before it leaves the estate, and such rubber is usually packed in cases. Many of the smaller Colombo dealers who ship exclusively to European ports also pack only in cases.

The question of baling rubber is receiving the close attention of the Research Scheme and any enquiries from estates or dealers who require practical advice will be welcomed. A more detailed note on the subject will be published in the next issue of the Quarterly Circular.

FIELD EXPERIMENTS ON DARTONFIELD ESTATE—XII

COMPARISON OF TAPPING SYSTEMS

R. K. S. MURRAY, *Botanist & Mycologist*
and
C. A. de Silva, *Assistant Botanist*

THE results for the first two years of an experiment on Dartonfield to compare eleven systems of tapping on mature seedling trees were given in a paper in the Second Quarterly Circular for 1939 (Vol. 16, Part 2). The following data refer to the third tapping year, *i.e.* March, 1939, to February, 1940 :—

Experimental Details

For full details of the experimental design, tapping and recording arrangements, etc., the reader is referred to the paper mentioned above. The lay-out is in six randomised blocks, each unit plot consisting of 30 trees.

The methods of tapping under comparison are given below, the abbreviations being in accordance with the revised version of the International Standard Notation, which is described elsewhere in this issue :—

Two-day series

1. Half spiral on alternate days, with change of panel every six months. Bark consumption $5\frac{1}{2}$ in. per annum. S/2, d/2 (2 ×6m/12), 100%.
2. Ditto with cycle of periodic rest, tapping for twelve months and resting for six months. Bark consumption $3\frac{3}{4}$ in. per annum. S/2, d/2 (2×6m/12), 12m/18, 67%.

Two-day series (*Contd.*)

3. Half spiral on alternate days, but on alternating sides, *i.e.* the tree is tapped on alternate days and each cut once in four days. Bark consumption 7 in. per annum. S/2, d/2 (2×2d/4), 100%.

4. Two-quarter spirals in echelon on alternate days, the bottom of the left cut being 6 in. below the top of the right. Change of panel every six months. Bark consumption $5\frac{1}{2}$ in. per annum. S/4//S/4, d/2 (2×6m/12), 100%.

5. "Double-Four," *i.e.* two opposite half spiral cuts once in four days. Bark consumption 7 in. per annum. S/2+S/2, d/4, 100%.

6. Ditto with cycle of periodic rest, tapping for twelve months and resting for six months. Bark consumption $4\frac{3}{4}$ in. per annum. S/2+S/2, d/4, 12m/18, 67%.

Three-day series

7. Half spiral once in three days, with change of panel every six months. Bark consumption $4\frac{1}{2}$ in. per annum. S/2, d/3 (2×6m/12), 67%.

8. "Double-Three," *i.e.* two opposite half spiral cuts once in three days. Bark consumption 9 in. per annum. S/2+S/2, d/3, 133%.

9. Ditto with cycle of periodic rest, tapping for six months and resting for six months. Sometimes known as Sunderland system. Bark consumption $4\frac{1}{2}$ in. per annum. S/2+S/2, d/3, 6m/12, 67%.

10. Ditto with cycle of periodic rest, tapping for twelve months and resting for six months. Bark consumption 6 in. per annum. S/2+S/2, d/3, 12m/18, 89%.

11. Ditto with cycle of periodic rest, tapping for eight months and resting for four months. Bark consumption 6 in. per annum. S/2+S/2, d/3, 8m/12, 89%.

The usual Ceylon custom of resting for three or four weeks during the annual period of refoliation is followed, so the tapping year actually consists of about 11 months. In the periodic systems the periods of tapping and rest are adjusted accordingly so that, for example, 12m/18 should really read 11m/16½.

Results

The results are expressed in a similar form to the previous paper.

Yield.—Table I gives the yields in kilograms total dry rubber per plot for the preliminary year 1936/37, the experimental year under reference 1939/40, and the latter adjusted by means of a regression on the former. The reasons for not expressing the results in terms of lb. per acre are given in the previous paper, but an approximate conversion factor is ×7.

This table also gives the proportion of scrap (tree scrap only) expressed as a percentage of the total crop. The figures may be rather high as an indication of the proportion of scrap which might be expected in commercial practice as the exclusion of partial " wash-outs " from the experimental results reduces the total yields on which the percentages are based.

The yields of the various systems as percentages of System No. 1 (S/2, d/2, 100%) are given in Table II for the three experimental years and for the whole period March, 1937, to February, 1940. It will be noticed that in 1939/40 nearly every treatment shows a substantial increase relative to the " control." This is owing to the fact that, for some unexplained reason, the yield of the half spiral alternate day plots showed a marked decline as compared with previous years. The comparative figures for 1939/40 must, therefore, be regarded with reserve unless and until confirmed by further results. For example, it would be unwise to conclude that the yield of System No. 8 (Double-Three) would normally show an increase in the third year of tapping. The figures in the last column of Table II, which refer to the full period 1937/40, afford a more reliable guide to the relative yields of the various systems as abnormal annual fluctuations become smoothed out over a period of years.

The progress of the total yield from the various systems as a percentage of No. 1 is illustrated in the graph, each point representing the cumulative yield up to that time. These yields have not been adjusted by a regression and, therefore, the positions as at February, 1940, do not quite conform to the figures in the last column of Table II. A subsidiary graph giving the adjusted percentages at the end of each tapping year is reproduced on the right.

Dry Rubber Content.—The mean monthly figures for dry rubber content of the latex are given in Table III, and the annual means in Table IV.

All systems show a satisfactory rubber content, the maintenance of a good figure for the "Double-Three" System (No. 8) being somewhat surprising. There are no significant differences in 1939/40 and the monthly fluctuations are inconsiderable.

Bark Renewal.—The progress of the renewal of cortex tapped in February, 1937, is shown in Table V. The largest difference in thickness after 37 months tapping is between Systems 1 and 6, where the advantage is 0·9 millimetres in favour of the latter. The difference, however, is not statistically significant.

Turning to the last column, which shows the increases between March, 1939, and March, 1940, differences which are judged to be significant by the usual statistical criteria are evident. In view of the difficulty, however, in making accurate measurements these apparent differences should not be emphasised, and it is impossible to correlate them with intensity of tapping or any other factor.

It is evident that under the conditions of the experiment the rate of bark renewal is not a factor of any importance in assessing the relative merits of the various systems under trial, but it might be unwise to apply this conclusion to trees which are in a less satisfactory general condition, or on which, for any reason, the rate of renewal is much slower.

Brown Bast.—Table VI gives the number of trees affected by Brown Bast in 1938, 1939 and 1940. The total number of trees tapped by each method is 180, so that the largest percentage of cases (System No. 8) is about 6·7%. There is a clear indication that the less intense systems of tapping have resulted in a smaller proportion of trees affected with this disease.

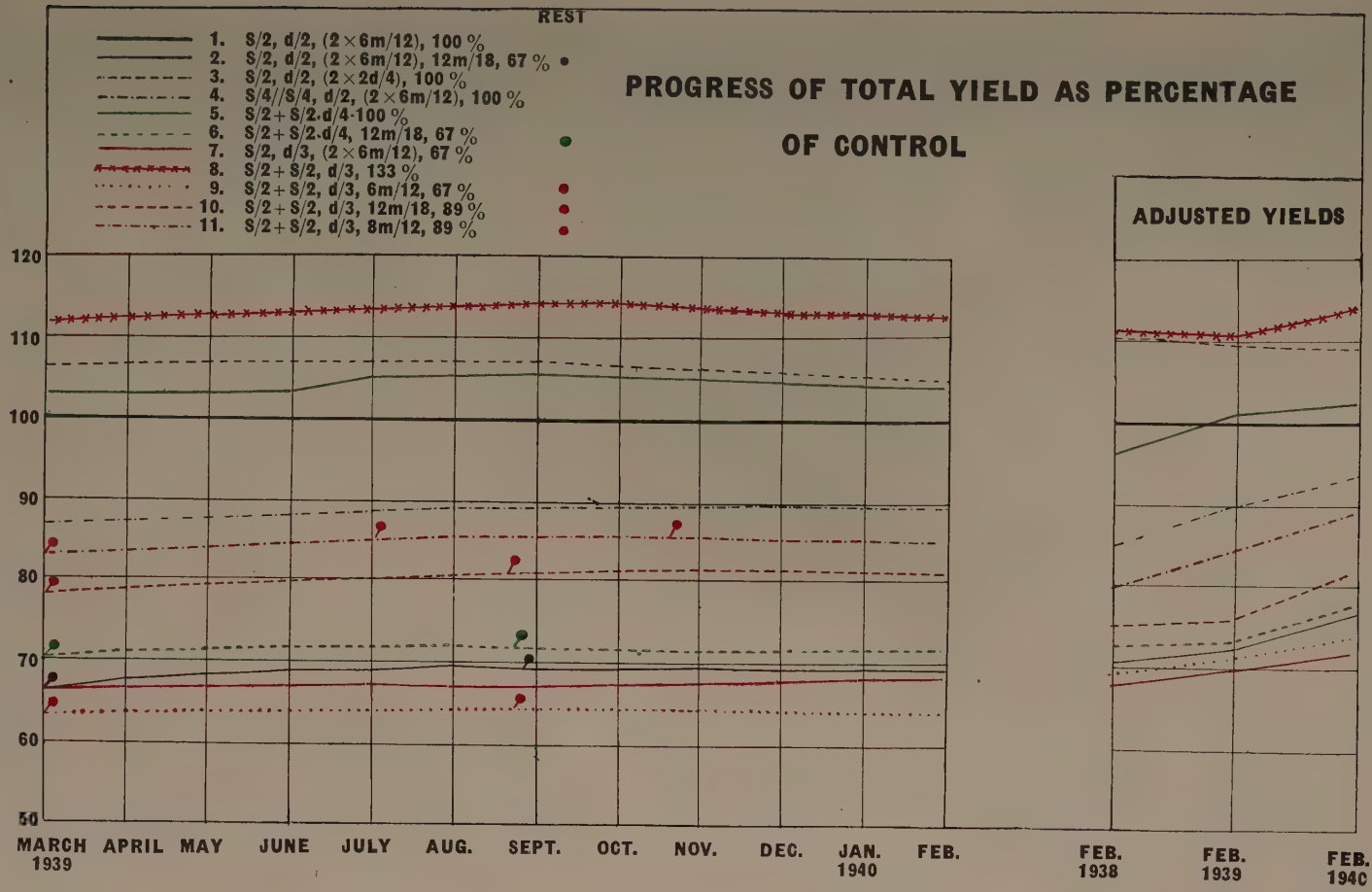
REST
1. S/2, d/2, (2×6m/12), 100 %
2. S/2, d/2, (2×6m/12), 12m/18, 67 %
3. S/2, d/2, (2×2d/4), 100 %
4. S/4//S/4, d/2, (2×6m/12), 100 %
5. S/2+S/2.d/4.100 %
6. S/2+S/2.d/4, 12m/18, 67 %
7. S/2, d/3, (2×6m/12), 67 %
8. S/2+S/2, d/3, 133 %
9. S/2+S/2, d/3, 6m/12, 67 %
10. S/2+S/2, d/3, 12m/18, 89 %
11. S/2+S/2, d/3, 8m/12, 89 %
PROGRESS OF TOTAL YIELD AS PERCENTAGE OF CONTROL
ADJUSTED YIELDS
120
110
100
90
80
70
60
50
MARCH 1939
APRIL
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
JAN. 1940
FEB.
FEB. 1938
FEB. 1939
FEB. 1940

TABLE I

MEAN YIELD IN KILOGRAMS TOTAL DRY RUBBER PER PLOT OF 30 TREES*

YEAR 1939 40

	Tapping System	Preliminary Year 1936/37†	Experimental Year 1939/40	Adjusted Yields 1939/40	Scrap as per cent. of Total
Sub-Block A Two-Day Series	1. S/2, d/2, (2× 6m/12), 100%	66·6	69·7	66·5	11·0
	2. S/2, d/2, (2× 6m/12), 12m/18, 67%..	60·9	53·9	57·6	11·2
	3. S/2, d/2, (2× 2d/4), 100%	64·1	72·9	72·7	11·0
	4. S/4//S/4, d/2, (2× 6m/12), 100% ..	63·9	68·4	68·4	10·1
	5. S/2+S/2, d/4, 100%	67·8	76·0	71·4	10·5
	6. S/2+S/2, d/4, 12m/18, 67%	62·3	55·6	57·5	8·8
Sub-Block B Three-Day Series	7. S/2, d/3, (2× 6m/12), 67%	63·3	52·0	52·9	12·0
	8. S/2+S/2, d/3, 133%	65·5	84·0	82·1	11·2
	9. S/2+S/2, d/3, 6m/12, 67%	59·0	48·7	54·6	11·5
	10. S/2+S/2, d/3, 12m/18, 89%	66·4	65·9	63·0	11·8
	11. S/2+S/2, d/3, 8m/12, 89%	63·6	66·8	67·2	10·8
	Mean	63·9	64·9	64·9	
	Standard error			3·4	
	Significant diff. (0·5) within sub-blocks			9·6	
	Do. between sub-blocks...			11·6	

*Approximate conversion to lb. per acre ×7.

†Ten months' tapping only.

TABLE II

ADJUSTED YIELDS AS PERCENTAGE OF SYSTEM No. 1

	Tapping System	1937/38	1938/39	1939/40	1937/40
Sub-Block A Two-Day Series	1. S/2, d/2, (2×6m/12), 100%	100·0	100·0	100·0	100·0
	2. S/2, d/2, (2×6m/12), 12m/18, 67%...	70·8	74·0	86·6	76·4
	3. S/2, d/2, (2×2d/4), 100%	110·4	108·6	109·3	109·3
	4. S/4//S/4, d/2, (2×6m/12), 100% ...	85·0	94·5	102·8	93·5
	5. S/2+S/2, d/4, 100%	96·8	105·7	107·4	103·0
	6. S/2+S/2, d/4, 12m/18, 67%	73·2	74·2	86·5	77·3
Sub-Block B Three-Day Series	7. S/2, d/3, (2×6m/12), 67%	67·8	71·2	79·5	72·2
	8. S/2+S/2, d/3, 133%	112·3	111·6	123·4	115·2
	9. S/2+S/2, d/3, 6m/12, 67%	69·0	73·6	82·1	74·3
	10. S/2+S/2, d/3, 12m/18, 89%	75·8	77·6	94·7	81·8
	11. S/2+S/2, d/3, 8m/12, 89%	81·0	89·0	101·0	89·6
	Mean	85·6	89·1	97·6	90·2
	Standard error	3·4	3·8	5·1	3·8
	Significant diff. (·05) within sub-blocks	9·5	10·6	14·4	10·6
	Significant diff. between sub-blocks	10·5	10·5	17·4	11·0

TABLE III

MEAN DRY RUBBER CONTENT PER CENT.

Months	TAPPING SYSTEMS										
	1	2	3	4	5	6	7	8	9	10	11
March, 1939 ...	41·3	42·9	40·2	42·5	43·1	43·8	42·6	41·5	43·9	43·4	42·1
April ,, ...	41·8	41·8	40·9	43·6	43·9	41·6	42·5	40·5	40·9	40·8	40·6
May ,, ...	40·0	38·5	39·6	41·5	41·0	42·0	41·1	40·4	38·8	39·7	39·3
June ,, ...	42·8	40·4	41·3	42·9	42·7	42·6	41·6	41·3	38·9	40·2	40·4
July ,, ...	40·6	39·0	39·2	40·9	40·3	41·1	42·4	40·6	37·9	39·1	41·0
August ,, ...	41·4	40·6	40·1	41·4	40·8	41·0	42·8	40·9	40·6	40·1	39·6
September ,, ...	43·5	44·1	41·7	42·9	42·9	41·8	43·9	41·4	44·5	42·1	39·8
October ,, ...	41·9	42·0	41·8	41·4	43·3	42·1	42 4	41·5	40·7	39·9	41·9
November ,, ...	40·6	40·0	40·2	40·1	41·4	41·0	41·5	41·6	39·9	40·0	41·3
December ,, ...	39·8	39·2	39·5	39·6	40·8	38·7	41·4	41·3	39·5	40·0	39·4
January, 1940 ...	40·2	39·7	39·9	40·6	41·5	39·2	41·4	40·7	39·2	39·4	38·8

N.B.—The figures underlined denote the months in which tapped and rested sections were changed over.

TABLE IV

DRY RUBBER CONTENT PER CENT.

Tapping Systems	1937/38	1938/39	1939/40
1. S/2, d/2, (2×6m/12), 100%	40·8	41·5	41·2
2. S/2, d/2, (2×6m/12), 12m/18, 67%	40·5	41·4	40·8
3. S/2, d/2, (2×2d/4), 100%	39·5	40·3	40·3
4. S/4//S/4,d/2, (2×6m/12), 100%	40·8	42·2	41·6
5. S/2+S/2, d/4, 100%	40·8	41·6	41·9
6. S/2+S/2, d/4, 12m/18, 67%	40·9	41·3	41·3
7. S/2, d/3, (2×6m/12), 67%	42·3	43·0	42·2
8. S/2+S/2, d/3, 133%	40·6	41·0	41·1
9. S/2+S/2, d/3, 6m/12, 67%	38·9	40·3	40·5
10. S/2+S/2, d/3, 12m/18, 89%	40·1	40·8	40·5
11. S/2+S/2, d/3, 8m/12, 89%	39·0	40·0	40·4
Mean	40·4	41·2	41·1
Error	0·51	0·46	
Significant diff. (·05) within blocks	1·4	1·3	Not significant
Do. between blocks	1·4	1·4	do.

TABLE V

THICKNESS OF RENEWING CORTEX IN MILLIMETRES

Tapping Systems	March, 1938 (13 mths.)	March, 1939 (25 mths.)	March, 1940 (37 mths.)	Increase 1939/40
1. S/2, d/2, (2×6m/12), 100% ...	5·8	6·6	6·7	0·1
2. S/2, d/2, (2×6m/12), 12m/18, 67%	5·8	6·9	7·1	0·2
3. S/2, d/2, (2×2d/4), 100% ...	5·9	6·8	7·0	0·2
4. S/4//S/4, d/2, (2×6m/12), 100%	5·9	6·6	7·0	0·4
5. S/2+S/2, d/4, 100%	6·0	6·7	7·3	0·6
6. S/2+/S2, d/4, 12m/18, 67% ...	5·9	6·9	7·6	0·7
7. S/2, d/3, (2×6m/12), 67% ...	5·9	6·6	7·4	0·8
8. S/2+S/2, d/3, 133%	5·8	6·8	7·3	0·5
9. S/2+S/2, d/3, 6m/12, 67% ...	5·9	6·8	7·2	0·4
10. S/2+S/2, d/3, 12m/18, 89% ...	5·9	6·9	7·2	0·3
11. S/2+S/2, d/3, 8m/12, 89% ...	6·0	6·6	7·1	0·5
Mean	5·9	6·7	7·2	0·4
Error				0·18
Significant diff. (·05) within blocks ...		Not significant		0·36
Do. between blocks		do.		0·36

TABLE VI

NUMBER OF TREES WITH BROWN BAST

Tapping System	No. of Trees with Brown Bast		
	June, 1935	June, 1939	June, 1940
1. S 2, d 2, (2 : 6m 12), 100%	6	6	4
2. S 2, d 2, (2 : 6m 12), 12m 18, 67%	2	2	3
3. S 2, d 2, (2 : 2d 4), 100%	2	5	8
4. S 2, S 2, d 4, (2 : 6m 12), 100%	2	4	—
5. S 2—S 2, d 4, 100%	2	8	11
6. S 2—S 2, d 4, 12m 18, 67%	2	4	7
7. S 2, d 3, (2 : 6m 12), 67%	2	3	4
8. S 2—S 2, d 3, 133%	8	11	12
9. S 2—S 2, d 3, 6m 12, 89%	4	6	8
10. S 2—S 2, d 3, 12m 18, 89%	4	5	8
11. S 2—S 2, d 3, 8m 12, 89%	2	8	—
Total	30	58	65

THE PERFORMANCE OF IMPORTED CLONES IN CEYLON—IV.

C. E. FORD, *Geneticist.*

Introduction

THIS report is the fourth of its series and records further yield data of imported clones. This information has mostly been supplied by various Ceylon estates whose co-operation is again gratefully acknowledged.

Presentation of Results and Notes on Tables

This year, for the first time, a number of yield figures derived from areas in commercial tapping are given, though with one exception they are taken from the records of commercial scale tapping experiments. These data are presented in Table I ; the remainder of the records are presented in the same form as in previous reports.

Table I.—The commercial tapping yield records are given in this table. In the case of the tapping experiments it has been considered sufficient to state the yield per acre and the average intensity of tapping over the whole area, rather than to give separate yield figures for each tapping treatment, a course that would make the table rather unwieldy.

Table II.—Contains estimated yield per acre figures of the clones in area 6 of the Iriyagama Division (see below). These are given in a separate table rather than in Table III on account of the more precise nature of the comparison.

Table III.—Apart from Table II, the most reliable comparisons between the performance of different clones can be drawn from

this table. Two criteria have been used in its construction, namely :

(1) Yields are grouped by areas in which the time of budding or planting, density of planting, and subsequent treatment have been as nearly as possible the same for all clones.

(2) Only clones with at least ten trees in test tapping are included.

Selection has, therefore, been more rigid and the yields from Estate B and the Wagolla Farm School, which were included last year, have now been excluded, the former because the tapped trees are situated in three different fields and the latter on account of the small number of trees in tapping.

Table IV.—This table contains all available data (with the exception of the commercial tapping figures) grouped by clones, and the performance of the several clones under a variety of conditions is thereby brought out.

A small number of the yield figures given in Table IV are estimated yields for the full year derived from the yield during a shorter period of tapping.

Table V.—Table V gives the yields of the original budgrafts of all the more important clones mentioned in this paper and also of certain other imported clones recently recommended for commercial planting by the Research Scheme.

When examining these tables, and particularly when comparing the records from different estates, it should always be remembered that in addition to tapping system, age of trees, year of tapping, etc. (which are recorded in the tables), differences occur in a great many other factors influencing yield. Soil fertility comes first, but density of planting and amount of subsequent thinning, height of cut, skill of tappers, manuring history, etc., are also concerned. The method of selecting trees for tapping, increases in the number of trees tapped between one year and the next, different ways of yield recording,—all modify yield in some degree. In view of the variability in these factors and the impossibility of allowing for them in the tables the following notes on areas from which records have been taken are given. If these notes are studied in conjunction with the tables themselves a better estimate of the significance of the yield figures will be obtained.

Tapping System Nomenclature

Symbolic representation of tapping systems has been used throughout this report in accordance with the revised standard international notation for tapping systems, an account of which is published in this number of the Quarterly Circular. The various tapping systems used and their symbolic equivalents on this notation are given below :—

One half spiral cut on alternate days	... S/2, d/2, 100%
One-third spiral cut on alternate days	... S/3, d/2, 67%
One half spiral cut every third day	... S/2, d/3, 67%
One full spiral cut every fourth day	... S/1, d/4, 100%
Two half spiral cuts every fourth day (" Double-Four " system).	... 2 S/2, d/4, 100%

Notes on Areas Tapped

General.—Notes on areas of principal interest only are given. The same clue letters are used as in the last report.

Iriyagama Division, Experiment Station, Peradeniya.—Estimated yield per acre figures of the clones in area 6 are given in Table II. This area is laid out as a randomised block experiment with five replications and hence affords a critical comparison between the various clones. Each plot contains 12 trees and occupies 0·12 acres, representing a planting density of 100 trees per acre.

The buddings were planted as budded stumps in October, 1929, and the seedlings as basket plants at the same time. The land was cleared from virgin jungle but early growth was slow. Manure was applied for the first time in 1935. Tapping was commenced in July, 1937, on the S/2, d/2, 100% system, cuts being opened at 36 inches above the union on the budded trees and at 24 inches above the ground on the seedlings. The tapping system was changed to S/2, d/3, 67% in January, 1938.

Even taking into account the mild system of tapping the general level of yield in the area is low, but this is no doubt largely due to the high elevation (about 1,600 feet). The yields of the various clones are seen in proper perspective when compared with the control seedlings. The Tjirandji clones show up well in this comparison. B.D. 5 is disappointing, but its growth has been poor.

Three new areas, numbers 7, 8 and 9, are now in progress, also on the S. 2, d. 3 system. Areas 7 and 8 are laid out as randomised block experiments, details of layout being the same as in area 6. Planting (budded stumps) was in 1934 and 1935 respectively. Area 9 is a small monoclone block of P.B. 25 planted as stumps in June, 1936, and budded in December, 1936. It is situated at the bottom of a hill and is rather dissected in comparison with the other areas. As in the case of area 6, the land for these three areas was cleared from virgin jungle and early growth was slow. Manure was first given in 1935.

In addition to P.B. 25, improved clones represented in these areas include A.V.R.D.S. 71 and A.V.R.D.S. 216, Bogor Redo 1 and Bogor Redo 2. Though yield per acre figures could be calculated as in the case of area 6, the clones are not of great general interest and so this has not been done.

Wagale Proposed Farm (Island, Kandy).—This is an area of about five acres which was planted with budded stumps of improved and local clones in 1937-38. The general yield level is exceptionally high. This is partly due to the wide spacing of the trees (approximately 20 to the acre) and partly to the fact that the soil is a rich alluvial loam.

B.D. 1 and B.D. 2 seem particularly well suited to the locality, but B.D. 10 and A.V.R.D.S. 49 have not done so well. One case of brown bast out of five trees tapped has recently occurred in both the above mentioned clones.

Farm A, Kalutara District.—In April, 1939, two commercial scale tapping experiments were commenced on monoclone blocks of B.D. 1 and T. 1 budded in 1931-32. There are three treatments (S. 2, d. 2, $100^{0}/_{0}$; a S. 2, d. 2, $100^{0}/_{0}$; S. 1, d. 2, $100^{0}/_{0}$) and four replications in the B.D. 1 experiment; and five treatments (the above three as well as S. 1, d. 2, $6^{0}/_{0}$, and S. 2, d. 3, $6^{0}/_{0}$) and two replications of the T. 1 experiment, two further replications of this experiment being located on Estate V. The tapped stand per acre works out at 121 trees (B.D. 1) and 121 trees (T. 1) respectively. In commercial practice these figures would be very slightly higher as a small number of immature trees were included when the experiment was laid out and these would be taken into tapping from time to

time. The only new trees brought into tapping replace trees damaged by wind ; trees developing brown bast are not replaced. The yield figures given in Table I are based on the actual weight of dry rubber, including scrap, and as stated in the notes on that table, are averaged over all tapping treatments.

Estate B, Kalutara District.—The B.D. clones on this estate are situated towards the top of a steep hill on poor soil cleared from jungle. There was no manuring in the early years and growth has been backward. Tj. 1 is more favourably placed on better soil near the bottom of the hill. All clones were budded in the field in June, 1930.

Estate D, Kalutara District.—An area of poor soil situated on the top of a knoll was replanted with budded stumps of six imported clones in 1930. No manure was given in the early years. Tapping commenced in April, 1937, when the trees were seven years old. Taking these conditions into account the general level of yield may be described as fair, though the increases over the 1938-39 figures are disappointing. The relative yields of the clones is now much as would be expected as B.D. 5 and Tj. 16 have increased in relation to B.D. 10 and the A.V.R.O.S. clones.

Estate E, Kurunegala District.—An area of chena soil was planted in 1929 and budded in 1931-32 with Tj. 16. The clearing has been manured regularly. Test tapping of 100 trees was commenced in 1937 and the whole clearing was taken into commercial tapping in April, 1939, on the S 2, d 2, 100 % system. The yield of 1,006 lbs. per acre in the first full year of tapping must be considered very good indeed, even taking into consideration the fact that the tapped stand per acre is 147 trees.

Estate F, Kegalle District.—The yield records from this estate are of trees in a single area of about six acres planted as budded stumps in 1930 on poor jungle soil. All trees of sufficient girth were test tapped from January, 1937, to January, 1940, when the field was taken into commercial tapping. The yields of clones with ten or more test tapped trees are given in Table III. The figures for the remaining clones, since they are derived from smaller numbers of trees, will not give such a reliable comparison and are

therefore only entered in Table IV. It is noteworthy that the yields of Tj. 1 and B.D. 2 which unaccountably declined during 1938-39, have now recovered.

Estate G, Galle District.—An 18-acre block was replanted with budded stumps in July, 1931, on poor soil. There was no manuring in the early years. All trees over 18 inches in girth were marked and 60 consecutive marked trees of each clone were selected for test tapping, which was commenced in July, 1937. A commercial scale tapping experiment was commenced in January, 1939, the unit plot being a tappers' task. The treatments are : S 2, d 2, 100% ; S/2, d/3, 67% and S/3, d/2, 67%.

For 8-year-old trees in their first full year of tapping the yields of Tj. 1 and A.V.R.O.S. 49 must be considered satisfactory. B.D. 5 is disappointing, but it has not grown so well and the tapped stand per acre is only about 100, whereas in Tj. 1 and A.V.R.O.S. 49 it is about 120 and 130 respectively.

Estate H, Ratnapura District.—A commercial scale tapping experiment was commenced in August, 1939, on a 21-acre monoclone block of Tj. 16 budded in 1931-32. The design of the experiment is in all essential features identical with the B.D. 5 experiment on Estate A. The unit plot is 200 trees and the tapped stand per acre 114.

Estate L, Ratnapura District.—An area of about one acre, well removed from other rubber, was planted in 1930 with budded stumps, 80 of which were successful. Forty-one were taken into tapping in April, 1935, and a further 27 in January, 1938. From January, 1936, individual tree biscuits were prepared. Although no manure was applied until August, 1937, growth has been very good, the average girth in 1939 being 35 inches. The clearing has suffered severely from wind damage. There have been six cases of brown bast up to December, 1939.

In Table IV the yields of 29 trees tapped continuously from January, 1936, are given. These yields are a little above the average for all trees tapped throughout any one year, but the difference is not very great.

Estate P, Kurunegala District.—An area of five acres of good jungle soil was planted with budded stumps in September, 1930. Ten selected trees of each clone were test-tapped in 1937-38 and gave very good yields. More trees (presumably of smaller girth) were taken into test tapping in March, 1938, and as a consequence the average yields of all clones for 1938-39 were lower than in the previous year. The 1939-40 figures show that all clones have given increased yields of the order of 2 lbs. per tree with the exception of Tj. 16 where there was a further decline. This clone suffered severely from wind damage when an adjacent protecting belt of Albizzias was cut out early in the year. If an unduly high proportion of the better yielding trees were lost in this way the further decline in yield would be accounted for.

Estate S, Matale District.—The chief feature of the yield records from this estate is the very poor showing of Tj. 1. The 20 trees of this clone are growing under very exceptional circumstances, being widely scattered over an exposed hillside which has recently been replanted. Although the trees have had full and unhindered opportunity for crown development the yield per tree in the first year of tapping was only 1·8 lbs. In 1939 it increased to 4·0 lbs. which, even taking the mild system of tapping into account, is still very poor for Tj. 1 at 8½ years old. A possible explanation may be the dry wind which sweeps over the hill, especially as the yield of Tj. 1 is known to fall off considerably during dry periods. If this be true yields should recover when the young buddings have grown sufficiently to afford some protection to the older trees.

The three B.D. clones have done well, but they are in a relatively favoured position at the bottom of the hill just mentioned. B.D. 2, B.D. 10, and 4 of the B.D. 5 trees were planted as budded stumps during the North-East Monsoon, 1929. Tj. 1 and the remainder of the B.D. 5 trees were budded in the field in 1931. The first application of manure was made in 1937.

Estate U, Matale District.—This estate is situated in an extremely dry locality. The area concerned was planted with budded stumps in 1928-30. Growth has been slow and test tapping was not commenced until April, 1938, when the trees were 8 to 9 years old.

Estate V, Kalutara District.—A five-acre area towards the bottom of a hill was replanted in 1932 with budded stumps of several imported and local clones, the system of planting being mixed polyclone at a density of about 168 per acre. The area has been manured regularly and the trees have grown well. Trees selected at random from those over 18 inches in girth were test tapped for one year commencing in November, 1938. Scrap is included in the yield figures.

Bearing in mind the high planting density, the yields given in Table III are very promising for seven-year-old trees in their first year of tapping. The yields of B.D. 5 and Tj. 16 are high in relation to Tj. 1 though a recent visit to the area suggests that Tj. 1 is now the highest producer and that B.D. 5 has fallen away. Considering the mild system of tapping Glenshiel 1 would also appear to have yielded well.

The clearing is now in commercial tapping.

Estate W, Kelani Valley.—An area of 29 acres was cleared from virgin jungle, planted in June, 1928, and budded in 1930/31. The soil is poor and growth has been backward. Stand per acre at present is about 115.

Nine clones are represented in the area and four were taken into tapping in March, 1939, on the 2 S/2, d/4 system, all trees above 18 in. girth at 3 ft. above the union being tapped. Yields are low for trees of $7\frac{1}{2}$ years. B.D. 10 is the best producer, though it is to be expected that Tj. 1 will more than catch up in later years. This clone may have been handicapped by choice of the tapping system (see notes on Tjirandji 1 below).

Estate X, Kelani Valley District.—The tapped area is a 45 acres 1928 clearing budded in 1931 at a density of 190 plants per acre. It was thinned slightly in 1938 and more drastically in 1939. Tapping was commenced in October, 1938, on the S/2, d/2, 100% system, the cuts being opened at 42 ins. above the union. In September, 1939, the tapped stand was 87 trees per acre and the total stand 133 trees per acre. The area is rocky, but there appear to be pockets of good soil. Growth has been poor. Yield of dry

rubber is estimated from volume of latex using metrolac readings. Scrap is included.

The general level of yield in the area is very low and it is uncertain whether this can entirely be attributed to the poor growth consequent upon the high planting density.

The relative performance of the different clones is interesting (see Table III). As would be expected, Tj. 1 takes first place, though B.D. 10 has a much higher proportion of trees in tapping. P.B. 23 has done well, and the position of A.V.R.O.S. 49 is satisfactory considering the poor early records of this clone in Ceylon. P.B. 25, though relatively well grown, is once again very disappointing.

Estate Y, Ratnapura District.—As stated above the Tj. 1 trees tapped on this estate constitute a further two replications of the tapping experiment described under Estate A. The lower yield of this area is undoubtedly due to poor growth consequent upon the high elevation (about 1,000 ft.) and the fact that the rubber is interplanted with tea. The number of tappings is also rather low owing to persistent interference by rain.

Estate Z, Kalutara District.—The area is approximately one acre in extent. It was planted as stumps in 1928 and budded in 1930. Tapping was commenced in September, 1938, at 36 inches above the union. Bark consumption was at the rate of 3/4 inch per month.

As the majority of trees were pollarded for budwood in 1936, the yields given in Table IV must be considered satisfactory. It will be noted that the yield of the trees tapped S/3, d/2 is high in relation to the trees tapped S/2, d/2. The Superintendent states that the first set of trees (S/3, d/2) are not favoured in comparison with the remainder, but have an advantage of $\frac{1}{2}$ inch in average girth. Tapping was discontinued after August, 1939.

Estate AA, Kalutara District.—The Tj. 1 and B.D. 5 yield records from this estate are taken from two separate replanted areas, on both of which the old rubber was very poor, though part of the B.D. 5 area consists of deniya land. The B.D. 5 was planted as budded stumps in 1931 ; Tj. 1 was planted seed at stake in 1930

and budded in 1931. Tapping was commenced in January, 1939, on the 2 S/2, d/4 system. The yield figures given are the actual total weights of dry rubber, including scrap.

Estate AB, Kurunegala District.—The area on this estate is a new clearing budded in the field in 1932-33. Growth has been good considering that no manure was applied in the early years. Tapping was commenced in April, 1939, on S/2, d/3, 67%; trees tapped were of 21 inches girth or over. The present stand is approximately 102 trees to the acre. The yield of dry rubber was estimated for each clone from uncorrected metrolac readings and is therefore liable to considerable error.

In view of this limitation, the only conclusion that may legitimately be drawn from the figures in Table III is that Glenshiel 1 has done very well and is probably the best yielding clone in the area.

Notes on Clones

Full notes on the clones of main importance were given in the last two reports of this series. Comment is here confined to fresh developments of interest.

Tjirandji 1.—The yield records of areas in commercial tapping, now available in general bear out earlier estimates of the clone's yielding capacity based on the test tapping of smaller groups of trees.

A slight defect of the clone mentioned in previous reports is the tendency for the flow to continue into the afternoon. This "late dripping" habit may assume more serious proportions when the interval between tappings is increased, resulting either in loss of crop or a high proportion of off-grades. Data from the large scale tapping experiment mentioned above indicate that the percentage of scrap and lump to total crop is regularly higher on three daily than on alternate daily tapping, and higher still when the interval between tappings is four days. When areas of Tj. 1 or other clones with the same late dripping habit are brought into tapping it is suggested either that a second collection be made or that the cup be replaced after collection and the late drip collected as lump on the next tapping day. Such procedure is unlikely to be necessary

when the cuts are first opened ; it could be commenced when the late drip begins to be excessive—indicated by the amount of accumulated earth scrap at the base of the tree.

In last year's report it was stated that " It is becoming increasingly clear that on the half spiral alternate day system there is a danger of an unduly high proportion of trees developing the disease," (Brown Bast). This statement was based on observations of trees in test tapping. It was added, " A large scale experiment to determine the best method of tapping trees of this clone (Tj. 1) has recently been started." Though this experiment is not yet sufficiently advanced for a final pronouncement to be made, the incidence of brown bast on the alternate day system is not high enough to justify the recommendation that the clone be tapped on a milder system (S/3, d/2 ; or S/2, d/3) right from the start, except, perhaps, where the stand per acre is relatively low. Nevertheless a careful watch on this disease should be kept so that a change-over to a milder system could be made if necessary.

Tjirandji 16.—Our confidence in the suitability of this clone for the drier districts is strengthened by the very fine yield given by the three-acre area on Estate E in its first full year of tapping. The performance of the clone in the wet zone is also very satisfactory ; in addition to its good first year yield of about 600 lbs. per acre on Estate H, in Table III it tops the list of clones on two out of the three wet zone estates where it is represented.

Bodjong Datar 5.—The commercial tapping yields of this clone on Estates A and X are much as would be expected. A general examination of the yield data for 1939 helps to confirm the view that it is a late maturing clone which is very susceptible to soil differences, being suited to deep fertile soils, particularly in the drier districts, but also to the deeper soils at the bases of the hills in other parts of the country.

Bodjong Datar 10.—In the last report of this series it was stated, " In general the performance of this clone is rather disappointing." The yield data for 1939 given in Tables I, III and IV make it necessary to revise this opinion, and show that it does relatively well in areas of poorer soil. The principal defect of the clone as reported

from Java is poor and uneven bark renewal. The clone, though a strong grower, is also rather liable to brown bast and wind damage.

A.V.R.O.S. 49.—Test tapping yields of this clone have been disappointing, but the commercial tapping yield figures from Estates G and X given in Table I are more promising and encourage the hope that this clone may yet turn out to be the best producer of the older A.V.R.O.S. clones in Ceylon and thus bear out its reputation in Sumatra.

Prang Besar 23.—The early yields of this clone are, in general, good in relation to other clones planted in the same area. On Estate X, for instance, P.B. 23 comes second only to Tj. 1 when the clones are arranged in order of yield per tree for the year.

The clone appears to have developed no important defect, but reports from Malaya suggest that although the early yield is good later increases may be less satisfactory than with other clones. It is no longer recommended for planting on a large scale either in this country or elsewhere.

Prang Besar 25.—The continued poor performance of this clone in test tapping is very disappointing when the fine results it has given in Malaya are remembered. As a consequence it has been removed from the Research Scheme's 1940 list of clones approved for large scale planting, though it may be reinstated if later yields show an improvement. A small monoclone area of this clone on Dartonfield will shortly be taken into tapping ; the yields from this area will be awaited with interest.

Prang Besar 86 *and Prang Besar* 186. Unfortunately the yield records of these clones in Ceylon are very few, but such as are available are satisfactory. Observations at Nivitigalakele suggest that the development of protuberant buds on P.B. 186 may not be so marked here as in Malaya, where this defect and the resultant wounding have been responsible for the removal of the clone from the Rubber Research Institute's approved list of planting material.

Glenshiel 1.—The records of this clone available in Ceylon are few but present indications are that early yield is high. In Malaya it is reported to develop dry areas on the cut when tapped on S/2, d/2, but records from one Ceylon estate show that on a milder

system there is a tendency to pre-coagulation. (See paper on "Tapping Young Budded Trees" by R. K. S. Murray, R.R.S. Quarterly Circular, Part 2 of 1940).

The clone is rather slow to mature, probably owing to its sparse branching habit. On this account it is recommended that planting be restricted to better soils.

Present Recommendations

A section on the Research Scheme's recommendations for planting material in 1940 was included in a paper presented by the writer at the Rubber Conference held in Colombo in April. The lists only are reproduced here; for further details reference should be made to the published text of the paper in the Conference programme or to the reprint in the Research Scheme's Quarterly Circular, Part 2 of 1940.

Recommended for Large Scale Planting

(Up to a limit of 25% of the total planting programme for any one clone):—

Tj. 1	Glenshiel 1
Tj. 16	Pilmoor B. 84
P.B. 86	Millakande 3/2
B.D. 5 (on deep fertile soil only)	

Recommended for Small Scale Planting

(Not more than 20% of the whole planting programme in all; no one clone or seedling family to take up more than 10%):—

(*a*) *Clones*

P.B. 25	A.V.R.O.S. 352
P.B. 186	P.R. 107
H.C. 28	WAR. 4
WG. 6278	Pilmoor D. 65
A.V.R.O.S. 255	

(b) Seedling Material

Tj. 1×Tj. 16	Prang Besar I. G.
Tj. 1×Tj. 1	Tjikadoe I. G.
A.V.R.O.S. 163 illegitimate	

Seedlings for Use as Stocks

A.V.R.O.S. 63 illegitimate

Tj. 1 illegitimate

B.D. 10 illegitimate

Failing these, well mixed seed from polyclone blocks or gathered near the boundaries of adjacent monoclone blocks.

References

Previous reports of this series were published in the Research Scheme's Quarterly Circular as follows :—

The Performance of Imported Clones in Ceylon I ...	... R.R.S. Quarterly Circular, Vol. 13, Parts 2 and 3, 1936
Do. II ...	... do. Vol. 15, Part 2, 1938
Do. III ...	... do. Vol. 16, Part 2, 1939

Earlier notes on imported clones were published as follows :—

Proved Hevea Clones I	... R.R.S. Quarterly Circular, Vol. 9, Parts 1 and 2, 1932
Do. II	... do. Vol. 10, Part 3, 1933

TABLE I

YIELDS FROM AREAS IN COMMERCIAL TAPPING

Clone	Estate and District	When budded or planted	Average intensity of tapping (S/2, d/2 = 100)	Area in acres	Yield in lbs. per acre for 1st tapping year
TJ. 1	A. Kalutara	1931-32	87	16	613
TJ. 1	G. Galle	1931	78	5·3	524
TJ. 1	Y. Ratnapura... ...	1930-32	87	18	440
TJ. 16	E. Kurunegala ...	1931-32	100	3	1006
TJ. 16	H. Ratnapura... ...	1931-32	100	21	605
B.D. 5	A. Kalutara	1931-32	100	20·5	438
B.D. 5	G. Galle	1931	78	3·6	382
A.V.R.O.S. 49 ...	G. Galle	1931	78	5·8	481

TABLE II

YIELDS OF IMPORTED CLONES IN AREA 6, IRIYAGAMA DIVISION, EXPERIMENT STATION, PERADENIYA, 1939

Planted Budded Stumps, 1929

Tapping on half spiral third day (S/2, d/3, 67%)

Clone	Mean girth ins. at 3 ft. on 22.7.40	Yield per tree in lbs. 1939	Yield in lbs. per acre	
			1939	Increase over 1938
TJ. 1	28·2	5·9	558	82
TJ. 16	26·9	5·5	524	22
TJ. 8	25·6	4·8	439	115
A.V.R.O.S. 49	25·8	3·0	297	42
A.V.R.O.S. 50	24·6	3·1	282	80
H. 2	27·6	3·1	252	79
S.R. 9	24·0	3·1	245	97
B.D. 5	22·9	2·6	223	37
Seedlings (Unselected) ...	31·8	2·2	215	76

Total tappings for year : 104.

TABLE III

YIELDS OF IMPORTED CLONES ON CEYLON ESTATES, GROUPED BY ESTATES

Tapping on half spiral on alternate days (S/2, d/2, 100%)
except where otherwise stated

Estate	D		F		N	
District	Kalutara		Kegalle		Kalutara	
Annual rainfall in inches	146		136		155	
When budded or planted	1930. Budded stumps		September, 1930. Budded stumps		1930. Budded in field	
Period of tapping	March, 1939-February, 1940		March, 1939-January, 1940		1939	
Yield in lbs. per tree for period stated. Number of trees tapped in brackets.	(79) TJ. 16	6·6	(54) TJ. 1	8·5	(12) A.V.R.O.S. 152	8·3
	(25) B.D. 5	6·5	(31) B.D. 10	7·9	(12) TJ. 8	6·3
	(44) B.D. 10	5·8	(29) B.D. 2	7·7	(12) A.V.R.O.S. 49	5·9
	(58) A.V.R.O.S. 49	4·7	(29) TJ. 16	7·6	(12) A.V.R.O.S. 50	4·8
	(61) A.V.R.O.S. 50	4·5	(27) A.V.R.O.S. 152	6·1		
	(94) DJ. 1*	4·0	(13) CT. 88	6·0		
			(21) B.D. 5	5·9		
			(22) TJ. 8	5·4		

*Identity of some trees doubtful.

TABLE III—(*Contd.*)

Estate	P		V		W	
District	Kurunegala		Kalutara		Kelani Valley	
Annual rainfall in inches	90		150			
When budded or planted	1930. Budded stumps		May, 1932		1931/32. Budded in field	
Period of tapping	March, 1939-February, 1940		November, 1938-October, 1939		March, 1939-February, 1940	
Yield in lbs. per tree for period stated. Number of trees tapped in brackets.	(31-19) TJ. 16	10·1	(25) TJ. 16	6·7	(106) B.D. 10	5·3
	(47-44) B.D. 10	8·5	(120) TJ. 1	5·8	(107) TJ. 1	4·8
	(20-15) TJ. 8	8·5	(30) B.D. 5	5·5	(133) B.D. 5	4·2
	(45) CT. 88	8·2	(110) G. 1	4·7†	(115) A.V.R.O.S. 49	2·7
	(45) B.D. 5	7·8				
	(39-34) B.D. 2	7·3	†*Tapped S/3, d/2, 67%*		*Tapped 2 S/2, d/4, 100%*	
	(47-41) A.V.R.O.S. 49	7·0				
	(45) A.V.R.O.S. 50	7·0				
	(42-39) A.V.R.O.S. 152	7·0				

TABLE III—(*Contd.*)

Estate	X		AB		Iriyagama Division Area 7	
District	Kelani Valley		Kuruncgala		Kandy	
Annual rainfall in inches					93	
When budded or planted	1931. Budded in field		1932-33. Budded in field		Oct.-Nov., 1930. Budded stumps	
Period of tapping	October, 1938-September, 1939		April-December, 1939		1939	
Yield in lbs. per tree for period stated. Number of trees tapped in brackets.	(702) TJ. 1	4·5	(73) G. 1	6·6	(49-58) P.B. 23	3·6
	(78) P.B. 23	4·1	(139) TJ. 1	4·3	(55-57) A.V.R.O.S. 256	3·3
	(106) TJ. 16	3·9	(350) TJ. 16	3·8	(24-47) H. 2	2·5
	(810) B.D. 10	3·8	(173) B.D. 2	3·6	(38) P. & T. 11	2·4
	(267) A.V.R.O.S. 49	3·8	(524) B.D. 5	3·4	(54-57) Seedlings (unselected)	1·8
	(22) P.B. 123	3·3	(316) B.D. 10	3·2		
	(136) A.V.R.O.S. 152	3·2	(175) A.V.R.O.S. 50	3·2		
	(658) B.D. 5	3·1				
	(201) A.V.R.O.S. 163	2·7	*Tapped S/2, d/3, 67%*		*Tapped S/2, d/3, 67%*	
	(26) S.R. 9	2·7				
	(418) P.B. 25	2·3				
	(435) A.V.R.O.S. 50	2·0				

TABLE III—(*Contd.*)

Estate	Iriyagama Division Area 8	
District	Kandy	
Annual rainfall in inches	93	
When budded or planted	Nov.-Dec., 1931. Budded stumps	
Period of tapping	1939	
Yield in lbs. per tree for period stated.	(51) B.R. 2	3·9
Number of trees tapped in brackets.	(48) B.R. 1	2·7
	(51) A.V.R.O.S. 71	2·2
	(47) H. 2	1·3
	Tapped S/2, d/3, 67%	

TABLE IV

YIELDS OF IMPORTED CLONES ON CEYLON ESTATES, GROUPED BY CLONES.

Tapping on Half-spiral on alternate days (S/2, D/2) unless otherwise stated.

Clone	Estate	District	No. of trees	Yield in lbs. per tree per annum at ages of (to the nearest half-year)																					
				4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½
TJ. 1	Iriyagama	Kandy	55-57	—		—		—		—		7·0		5·1*		5·9*							
Do.	A	Kalutara	200	—		—		7·2															
Do.	B	Kalutara	10	2·3		3·7		6·5		5·9†		8·0†		8·0†									
Do.	C	Ratnapura	12	—		—		6·6		8·3													
Do.	F	Kegalle	36-54	—		—		—		7·4		5·4		8·5									
Do.	G	Galle	60		—		—		6·5														
Do.	H Area 1	Ratnapura	400	—		—		—		8·1		7·5											
Do.	H Area 2	Ratnapura	400	—		—		—		6·4													
Do.	I	Kalutara	32-37		—		—		6·8		9·7		11·8		11·2								
Do.	J	Kegalle	48-44	—		—		—		—		6·7		9·7									
Do.	K	Kalutara	3-10	3·0		4·6		4·9		6·6													
Do.	L	Ratnapura	29	—		—		5·9		11·7		13·9		14·4									
Do.	R	Ratnapura	240-200	—		—		9·0		6·1													
Do.	S	Matale	20		—		—		—		1·8*		4·0*										
Do.	T	Kalutara	627		—		—		5·4*														
Do.	U	Matale	32		—		—		—		—		5·9		6·7								
Do.	V	Kalutara	120	—		—		—		5·8													
Do.	W	Kelani Valley	107		—		—		—		4·8‡												
Do.	X	Kelani Valley	702		—		—		—		4·5												
Do.	Z	Kalutara	57		—		—		—		—		5·4										
Do.	Z	Kalutara	57		—		—		—		—		5·1†										
Do.	AA	Kalutara	500	—		—		—		—		5·5‡											
Do.	AB	Kurunegala	139	—		—		—		5·1*													

*Tapped on S/2, d/3. †Tapped on S/3, d/2. ‡Tapped on 2S/2, d/4.

TABLE IV—(*Contd.*)

Clone	Estate	District	No. of trees	Yield in lbs. per tree per annum at ages of (to the nearest half-year)																					
				4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½
TJ. 8	Iriyagama	Kandy	39-56	—		—		—		—		4·0		3·9*		4·8*									
Do.	N	Kalutara	12	—		—		2·6		3·6		6·0		6·3											
Do.	P	Kurunegala	10-30	—		—		—		9·7		6·3		8·5											
Do.	U	Matale	3		—		—		—		—		3·3												
TJ. 16	Iriyagama	Kandy	52-57	—		—		—		—		5·5		5·5*		5·5*									
Do.	D	Kalutara	77-80	—		—		—		3·6		5·8		6·6											
Do.	E	Kurunegala	100		—		—		6·6		9·9														
Do.	F	Kegalle	21-29	—		—		—		6·1		6·3		7·6											
Do.	H	Ratnapura	400	—		—		—		5·4															
Do.	I	Kalutara	21-30		—		5·5		7·2		8·2		8·4												
Do.	O	Kalutara	29-30		—		—		—		8·5		9·6												
Do.	P	Kurunegala	10-32	—		—		—		13·8		11·2		10·1											
Do.	U	Matale	59		—		—		—		—		4·6		6·0										
Do.	V	Kalutara	25	—		—		—		6·7															
Do.	X	Kelani Valley	106		—		—		—		3·9														
Do.	AB	Kurunegala	350	—		—		—		4·5*															
B.D. 2	B	Kalutara	10	—		—		3·0		4·8		3·7		5·0											
Do.	F	Kegalle	22-29	—		—		—		7·6		6·8		7·7											
Do.	P	Kurunegala	10-39	—		—		—		9·0		6·2		7·3											
Do.	S	Matale	4	—		—		—		—		5·2*		6·8*		9·2*									
Do.	U	Matale	2		—		—		—		—		5·0												
Do.	AB	Kurunegala	173	—		—				4·3*															
Do.	Wagolla	Kegalle	5		—		—		—		—		—		18·3		18·6		17·1						

*Tapped on S/2, d/3.

TABLE IV—(*Contd.*)

Clone	Estate	District	No. of trees	Yield in lbs. per tree per annum at ages of (to the nearest half-year)																	
				4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½
B.D. 5	Iriyagama	Kandy	22-52	—		—		—		—		3·8		2·7*		2·6*							
Do.	A	Kalutara	200	—		—		4·7															
Do.	B	Kalutara	10	—		—		3·3		4·7		4·2		4·4									
Do.	C	Ratnapura	12	—		—		—		4·4													
Do.	D	Kalutara	19-25	—		—		—		4·0		5·5		6·5									
Do.	G	Galle	60		—		—		4·5														
Do.	K	Kalutara	10	—		—		3·8		5·2													
Do.	P	Kurunegala	10-48	—		—		—		9·7		6·6		7·8									
Do.	S	Matale	14-28		—		—		4·0*		4·7*		7·7*										
Do.	R	Ratnapura	200	—		—		—		5·2													
Do.	T	Kalutara	20		—		—		3·6*														
Do.	U	Matale	46-43		—		—		—		—		5·0		6·1								
Do.	V	Kalutara	30	—		—		—		5·5													
Do.	W	Kelani Valley	133		—		—		—		4·2‡												
Do.	X	Kelani Valley	658		—		—		—		3·1												
Do.	AA	Kalutara	500	—		—		—		—		5·3‡											
Do.	AB	Kurunegala	524	—		—		—		4·0*													
Do.	AC	Uva	22	—		—		—		—		6·8		7·3									
Do.	Wagolla	Kegalle	5		—		—		—		—		—		19·8		21·9		23·5				
B.D. 10	A	Kalutara	200	—		—		4·0															
Do.	B	Kalutara	10	—		—		3·1		4·9		4·4		4·6									
Do.	D	Kalutara	29-44	—		—		—		4·7		5·9		5·8									
Do.	P	Kurunegala	10-47	—		—		—		9·2		6·7		8·5									

*Tapped on S/2, d/3. ‡Tapped on 2S/2, d/4.

TABLE IV—(*Contd*)

Clone	Estate	District	No. of trees	Yield in lbs. per tree per annum at ages of (to the nearest half-year)																					
				4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½
B.D. 10	S	Matale	5	—		—		—		—		3·5*		5·9*		9·7*									
Do.	U	Matale	2		—		—		—		—		2·3												
Do.	W	Kelani Valley	106		—		—		—		5·3‡														
Do.	X	Kelani Valley	810		—		—		—		3·8														
Do.	AB	Kurunegala	316	—		—		—		3·8*															
Do.	Wagolla	Kegalle	3		—		—		—		—		—		7·2		9·4		8·7						
A.V.R.O.S. 49	Iriyagama	Kandy	54-59	—		—		—		—		3·5		2·7*		3·0*									
Do.	A	Kalutara	200	—		—		3·1																	
Do.	C	Ratnapura	12	—		—		—		3·2															
Do.	D	Kalutara	51-59	—		—		—		2·9		4·5		4·7											
Do.	E	Kurunegala	100		—		—		4·7		6·4														
Do.	G	Galle	60		—		—		4·1																
Do.	N	Kalutara	12	—		—		3·4		3·8		5·7		5·9											
Do.	P	Kurunegala	10-48	—		—		—		7·8		5·1		7·0											
Do.	U	Matale	9		—		—		—		—		3·4												
Do.	W	Kelani Valley	115		—		—		—		2·7‡														
Do.	X	Kelani Valley	267	—		—		—		—		3·8													
Do.	Wagolla	Kegalle	3		—		—		—		—		—		6·0		9·8		10·4						
A.V.R.O.S. 50	Iriyagama	Kandy	44-54	—		—		—		—		3·5		2·4*		3·1*									
Do.	A	Kalutara	200	—		—		3·8																	
Do.	C	Ratnapura	6	—		—		—		2·6															

*Tapped on S/2, d/3. ‡Tapped on 2S/2, d/4.

TABLE IV—(*Contd.*)

Clone	Estate	District	No. of trees	Yield in lbs. per tree per annum at ages of (to the nearest half-year)																					
				4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½
A.V.R.O.S. 50	D	Kalutara	50-61	—		—		—		3·1		4·3		4·5									
Do.	P	Kurunegala	10-45	—		—		—		7·4		5·4		7·0									
Do.	U	Matale	5		—		—		—		—		2·8										
Do.	X	Kelani Valley	435		—		—		—		2·0												
Do.	AB	Kurunegala	175	—		—		—		3·8*													
A.V.R.O.S. 71	Iriyagama	Kandy	51	—		—		—		—		2·2*											
Do.	Wagolla	Kegalle	2		—		—		—		—		—		8·2		10·2		13·1				
A.V.R.O.S. 80	N	Kalutara	12	—		—		3·0		4·1		6·1		4·8									
A.V.R.O.S.152	N	Kalutara	12	—		—		3·5		5·4		6·8		8·3									
Do.	P	Kurunegala	10-48	—		—		—		6·9		5·1		7·0									
Do.	U	Matale	3		—		—		—		—		2·4										
Do.	X	Kelani Valley	136		—		—		—		3·2												
Do.	Wagolla	Kegalle	1		—		—		—		—		—		14·8		16·2		16·4				
A.V.R.O.S.163	U	Matale	8		—		—		—		—		3·8										
Do.	X	Kelani Valley	201		—		—		—		2·7												
A.V.R.O.S.256	Iriyagama	Kandy	55-57	—		—		—		—		1·4*		3·3*									
Do.	G	Galle	60	—		—		2·7															

*Tapped on S/2, d/3.

TABLE IV—(*Contd.*)

Clone	Estate	District	No. of trees	Yield in lbs. per tree per annum at ages of (to the nearest half-year)																					
				4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½
Djasinga 1	D	Kalutara	61-94	—		—		—		2·1		2·5		4·0											
Do.	N	Kalutara	12	—		—		3·0		3·9		6·3		3·8											
Do.	Q	Kalutara	10-8		—		4·2		5·0		6·1		4·9*		4·7*										
Do.	U	Matale	4		—		—		—		—		2·1												
Do.	X	Kelani Valley	6	—		—		—		—		4·3													
CT. 88	P	Kurunegalle	45	—		—		—		—		—		8·2											
Do.	U	Matale	5		—		—		—		—		3·8												
Do.	Wagolla	Kegalle	3	—		—		—		—		—		—		13·7		11·0		9·5					
P.B. 23	Iriyagama	Kandy	37-58	—		—		—		—		3·3*		3·6*											
Do.	Iriyagama	Kandy	89-96	—		—		—		—		4·6*		5·4*											
Do.	Nivitigalakele	Kalutara	10-9		—		1·3		2·7		7·5		7·7												
Do	F	Kegalle	4	—		—		—		—		6·1		9·5											
Do.	Q	Kalutara	3	—		3·7		3·6		5·5		6·4*		5·3*											
Do.	X	Kelani Valley	78	—		—		—		—		4·1													
P.B. 24	F	Kegalle	5	—		—		—		—		3·2		4·5											
P.B. 25	Nivitigalakele	Kalutara	9	—		—		1·4		3·9		5·9		5·6											
Do.	F	Kegalle	2	—		—		—		—		—		3·9											
Do.	I	Kalutara	49	—		—		—		3·1															
Do.	Q	Kalutara	3	—		5·1		6·8		8·2															
Do.	X	Kelani Valley	418		—		—		—		2·3														

*Tapped on S/2, d/3.

TABLE IV—(*Contd.*)

Clone	Estate	District	No. of trees	Yield in lbs. per tree per annum at ages of (to the nearest half-year)																	
				4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½
P.B. 86	F	Kegalle	3	—		—		—		8·6		9·4		9·5									
P.B. 123	F	Kegalle	3	—		—		—		—		6·7		9·3									
Do.	X	Kelani Valley	22	—		—		—		—		3·3											
P.B. 155	F	Kegalle	4-2	—		—		—		—		5·0		8·3									
P.B. 180	F	Kegalle	2-3	—		—		—		3·5		4·8		6·0									
P.B. 186	Nivitigalakele	Kalutara	21		—		—		—		4·0												
Do.	F	Kegalle	6	—		—		—		—		—		4·3									
S.R. 9	Iriyagama	Kandy	48	—		—		—		—		—		3·1*		3·1*							
Do.	X	Kelani Valley	26	—		—		—		—		2·7											
Do.	Wagolla	Kegalle	9	—		—		—		—		—		—		12·0		13·0		14·2			
B.R. 1	Iriyagama	Kandy	48	—		—		—		—		2·7*											
Do.	Wagolla	Kegalle	4	—		—		—		—		—		—		12·7		15·7		16·0			
B.R. 2	Iriyagama	Kandy	51	—		—		—		—		3·9*											
Do.	Wagolla	Kegalle	4-3	—		—		—		—		—		—		16·8		14·8		10·2			
G. 1	V	Kalutara	110	—		—		—		4·7†													
Do.	AB	Kurunegala	73		—		—		7·7*														

*Tapped on S/2, d/3. †Tapped on S/3, d/2.

TABLE V

YIELD OF ORIGINAL BUDDINGS IN COUNTRIES OF ORIGIN

Clone	Year planted or budded	No. of trees	Yield in lbs. dry rubber per tree at ages of (to nearest half-year)																													
			4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	15½	16	16½	17	17½	18	18½	19	19½	20	20½	21
TJ. 1	1920	2	—		—		—		—		30·6		26·6		35·2		41·4		33·4		42·9		39·6		42·5		86·2		62·5		59·5		45·5			
TJ. 16	1920	9	—		—		—		—		24·0		23·8		20·1		21·3		27·5		20·4		25·5		27·9		45·1		40·5		40·9		32·3			
B.D. 5	1918	7		—		—		—		—		18·5		25·3		26·0		26·6		29·9		36·1		34·5		33·7		31·7		31·7		33·0			
B.D. 10	1918	40		—		—		—		—		15·7		18·9		20·0		17·8		21·1		21·8		21·3		23·1		22·8							
Djasinga 1	1920	135		—		—		—		—		9·7		11·0		15·0		14·3		17·2		19·8		24·2		23·5		20·0		16·3		18·3			
A.V.R.O.S. 49	1919	4		3·1		6·4		9·2		11·4		10·6		13·2		17·2		19·6		23·1															
P.B. 25	1922	10		—		12·4		13·9		15·1		20·1		22·1		22·9		—		—		—		24·1*		24·5*									
P.B. 86	1923	10	10·2		12·3		14·9		18·5		21·1		23·9		—		—		—		21·4*		23·2*												
P.B. 186	1922	10		—		11·2		15·6		20·6		27·6		26·3		29·5		—		—		—		22·7*		21·7*									
Glenshiel 1	1921	20	—		—		10·7		11·1		22·7		22·4		22·2		25·9		22·1		20·3														
Pil. B. 84	1924	18	5·3		7·0		9·2		12·3		15·9		18·5		19·2		21·5		17·7		19·4		21·1												
Pil. D. 65	1924	5	4·4		11·0		15·8		18·9		20·0		26·0		23·2		23·0		17·6		21·2		22·0												
War. 4	1918	39		—		—		—		—		—		—		—		20·2		31·7		28·2		24·4		25·7		27·1		29·0		27·1		25·5		22·7
A.V.R.O.S. 255	1925	13		—		—		9·2		10·3		15·8		13·0		17·6		21·8		18·5		20·5													
A.V.R.O.S. 352	1930	18-14		—		6·6		12·3		17·6																									
PR. 107	1923	9		—		5·3		6·8		10·3		13·0		15·0		16·7		21·6		24·2		24·2		28·6		26·8									

(*Figures calculated from recent test tappings of about 60 trees of each clone)

SOME ASPECTS OF THE MANURING OF MATURE RUBBER

L. A. WHELAN, *Soil Chemist*

I HAVE chosen this subject because of its great economic importance, which has become complicated of late by the rising cost of fertilisers and the uncertainty of the future market value of rubber, and I have chosen rather an inclusive title because, whilst the aspects that should be considered in drawing up a manuring policy for old rubber are many, our knowledge of some of these is meagre and at times appears to be conflicting.

Distinction between Young Rubber and Old Rubber

In the case of young budded rubber the object of manuring is to bring the trees into tapping as early as possible, and to reach and maintain as high a yield as possible. For this purpose a satisfactory manuring programme must be planned and attention should be paid to cultivation from the beginning of replanting.

With mature rubber the problem is somewhat different. Past cultivation and yield should be considered, and the decision arrived at should be viewed in the light of the future general policy of the Company. Any scheme suggested as suitable for the manuring of mature rubber in the Island must be regarded only as a guide and may require modification to fit the conditions and policy of the estate concerned.

Necessity for Manuring

The once commonly accepted belief in the inexhaustible fertility of tropical soils is fast dying out, and the advantages that result from the manuring of tropical crops generally is now admitted.

The more or less stable system found under tropical jungle tends to be seriously upset when the land is cleared and the probability of soil erosion still further increases the need for attention to the supply of available plant foods. When the tree has reached maturity, it is probable that there will be less need than in its earlier years for the addition of certain plant foods owing to the more efficient exploitation of the nutrients in the soil by a well-developed root system and to the general slowing down of the rate of growth. It is advisable, however, with our present lack of precise information, to give occasional doses of suitable manure so as to safeguard the general health and yield of the tree.

General estate experience in Ceylon extending back a number of years leads to the conclusion that some form of manuring is needed on most soils if the yield of latex is to be maintained, but it cannot be said that this is supported by critical field trials. The often quoted Sumatra experiment in which the application of nitrogenous manure was found to effect a marked increase on yield supports this view; nitrate of soda, for example, was found to have increased the yield after eight years from 280 lbs. per acre on the unmanured plots to 760 lbs. on the manured. In considering this result it should be remembered that the trial was carried out on a white loam peculiar to the east coast of Sumatra and particularly poor in plant food.

Manuring in the Light of General Estate Policy

It has been pointed out in Malaya that application of manure cannot be expected to produce at once an increase in the flow of latex. The first sign of response to manuring may be looked for in vegetative improvement, first in the foliage and then in the renewal of bark. This may be followed by an increase in the yield of latex, but some considerable time may elapse between the application of manure and the improvement in yield. Should the Company decide to replant within that period little or no economic return may be expected. If no such policy has been planned, but the trees are of considerable age and poor in appearance and yield, the wisdom of carrying out an expensive cultivation policy is doubtful, and the alternative one of replanting with high yielding material should be given consideration.

The manuring should be carried out according to a planned but flexible programme in preference to odd doses of manure applied with little reference to past history or present condition of the stand. This brings up a number of important questions : what plant foods are needed, how much and in what form, when should they be applied and how ? These questions can best be answered in the light of experience, obtained either as a result of careful and unbiassed general observation over a number of years or from carefully planned field experiments. A knowledge of the appearance of the jungle, the yield from the old rubber on the area, soil analysis and results obtained at other centres or in other countries are all of value, but should be used with discretion.

The Plant Foods Needed

The first point mentioned above, the plant foods required, is obviously of primary importance as on it may depend the success or otherwise of the manuring, at least its economic success. If response to nitrogen fails because phosphate or potash has been omitted, or if, on the other hand, the addition of phosphate and potash has not increased the response given by nitrogen alone, the result of manuring cannot be regarded as completely successful.

The amount of plant food removed from the land when the latex is sent to the factory is surprisingly small when compared with other crops. For example, it has been calculated that the quantity of nitrogen removed annually per acre in 350 lbs. rubber is approximately 1/12 of that removed by wheat, the phosphate only 1/16 and the potash less than 1/100. The use of high yielding clones would, of course, bring the nitrogen to a more comparable level.

Due to leaf-fall, a considerable part of the nutrient taken up by the tree is returned to the soil, but of the nutrient lost, nitrogen is again the most concerned. Some of the nitrogen may be lost in the gaseous form as ammonia, and after conversion to nitrate a further loss of nitrogen may occur due to leaching.

It would be reasonable to assume on theoretical grounds that this fugitive element nitrogen is the one that is most likely to be required, and experiments have in general borne this out. Trials

carried out in other countries, and supported to some extent by the Dartonfield experiment have, however, indicated that it may be unwise to follow this assumption too far, and conclude that nitrogen alone is always sufficient for mature rubber.

The wisdom of including phosphate and potash in the manuring programme for soils, for which no precise information is available, has been pointed out by the Rubber Research Institute of Malaya, and this is suggested not because the addition of phosphate and potash is known to be essential always but because it constitutes a valuable insurance. But as has been pointed out by the R.R.I. the decision as to whether this insurance should be taken out must lie with the Company.

Dartonfield Manurial Experiment

I shall now refer to an experiment at present in progress on Dartonfield. The trees, which are now 23 to 30 years old, were given the first application of experimental manures at the end of 1936 and further applications in 1937 and 1938. This experiment was fully described in the first Quarterly Circular for 1940 and only a short summary will be given this morning.

In the following table the actual yields of dry rubber obtained in the three experimental years were adjusted by means of a correction based on the preliminary yields of 1936, and the plot yields in kilograms were then converted to pounds per acre. The yield in pounds per acre is given only for the unmanured plots, the yields for the manured are expressed as percentages of the unmanured :—

Treatment	Year 1936	1937	1938	1939
O	Mean value of 583 lbs. (for all treatments)	493 lbs.	550 lbs.	437 lbs.
N		111%	114%	112%
NP		106%	106%	104%
NK		110%	113%	111%
NPK		111%	119%	117%

In 1937, the year following the first application of manures, the control plots yielded 493 lbs. per acre and statistically significant increases were obtained of 55 lbs. for nitrogen, 47 lbs. for nitrogen plus potash and 53 lbs. for a nitrogen phosphate potash mixture. The combination of nitrogen and phosphate failed to give a significant response.

In 1938 the control plots yielded 550 lbs. per acre and significant increases were obtained of 76 lbs. for nitrogen, 72 lbs. for nitrogen plus potash and 102 lbs. for the mixture of nitrogen phosphate and potash. Again the nitrogen phosphate mixture failed to give a significant response, but it is interesting to note that the addition of potash to such a mixture raised the yield significantly by 70 lbs. per acre. The mean yield for 1939 (476 lbs. per acre) was the lowest since the start of the experiment owing perhaps to the decrease in the number of tappings brought about by unfavourable weather conditions. The treatment responses, although apparently similar to those of the previous years, are not statistically significant. The results to date suggest with some measure of statistical support, that nitrogenous manuring has had a considerable effect on yield and there is an indication that the addition of phosphate and potash to nitrogen has given a further increase, but this lacks statistical backing. There is also evidence, reaching the lower conventional standard of statistical significance, that on this soil a nitrogen phosphate mixture is much improved by the addition of potash.

It is suggested that whilst the results from the above experiment are valuable, the conclusions drawn should be treated with reserve until further results have been obtained. For the same reason, it is considered too early to attempt to arrive at a decision on the economics of such a manuring policy.

The manurial treatments have apparently had no effect on growth, as measured by girth increment and bark renewal. Since the taking of the first girth measurements in 1937 the trees have shown very little increase in girth, the general average for all treatments (including the control) being only 0·3 inches per year. The increase in thickness of the renewed bark in millimetres for the two-year period 1938-1940 was as follows :—

Treatment Plots	O	N	NP	NK	NPK
Bark Renewal	1·2	1·2	1·4	1·2	1·5

The results are statistically non-significant, and the general response to manuring can only be regarded as doubtful although there are indications that phosphate may be of some importance.

Quantity of Manure

On this point there is very little evidence available from Ceylon trials. Useful information can be obtained from a study of Grantham's experiment on the nutrient-poor, white loam soil of Sumatra, already referred to in this paper. His conclusions were that annual dressings of 0·8 lb. nitrogen per tree gave the quickest and best response, but that the same dressing applied biennially gave a response only slightly less. Half dressings (*i.e.*, 0·4 lbs. nitrogen) given biennially were definitely too small.

Rubber Research Scheme's General Recommendations

From a general consideration of the above results, and from findings obtained in other countries a scheme of manuring for mature rubber has been suggested by the Rubber Research Scheme. In this, nitrogen plays the chief part, but until more is known of the nutrient requirements of Hevea on different soil types the occasional addition of phosphate and a smaller amount of potash is advised. Apart from the increase in yield of rubber which may be expected under certain conditions of soil and tree, the application of potash and still more that of phosphate is likely to result in an improved growth of cover.

The general manuring programme recommended is a biennial application consisting alternately of 60 lbs. nitrogen per acre and a mixture containing 60 lbs. nitrogen, 20 lbs. phosphoric acid and 12½ lbs. potash.

Form in which Nutrients are Applied

The form in which the plant food is applied is, on the whole, of secondary importance, but considerations of price and bulk should always be given attention.

Sixty pounds of nitrogen would be contained in 291 lbs. of sulphate of ammonia, 300 lbs. of calcium cyanamide, 375 lbs. of nitrate of soda or 857 lbs. of ground-nut cake. Under normal conditions of supply we advise alternating the form of nitrogen

between sulphate of ammonia and calcium cyanamide on the assumption that the occasional application of the calcium contained in the latter may be of value to the plant. The use of artificial organic manures for mature rubber is not recommended owing to the high cost of material, the additional transport and the necessity for digging this manure into the soil. Owing to restrictions brought about by the war, sulphate of ammonia is at present not obtainable and the choice of a suitable nitrogenous manure is limited to nitrate of soda and calcium cyanamide. If manuring has to be done at a time when heavy rain may be expected, nitrate of soda is not recommended owing to a possible loss by leaching. Apart from this the most important aspect is probably that of cost per unit of nitrogen and this may suffer variation.

With respect to phosphate, the common manures are rock phosphate, superphosphate, basic slag and bone manure. On the basis of phosphoric acid content the cheapest form of pre-war phosphate was rock phosphate followed by bone meal. Basic slag and superphosphate were considerably more expensive. Superphosphate owes its high price to the fact that it has a greater content of water soluble phosphoric acid than the other forms mentioned and for that reason it is recommended for the drier districts. With respect to acid soils in districts of high rainfall there is some evidence that finely ground rock phosphate is as satisfactory as the more expensive superphosphate. Due to conditions brought about by the war it may be expected that the differences in price between rock phosphate and the manufactured forms such as basic slag and superphosphate may widen still further. If allowance is made for the small amount of nitrogen in bone meal, there is at present very little difference in the unit of price of phosphoric acid in rock phosphate and in bone meal.

Potash calls for no comment as both the muriate and the sulphate are suitable for rubber, and the choice between them should be controlled by cost per unit.

There is at present a restriction on the amount of potash that will be supplied for the manuring of rubber over seven years old.

Plant foods in the form of compost or cow manure should be suitable for rubber, but apart from the difficulty that may be

experienced in obtaining the large quantity needed for mature trees, the necessity for digging in such bulky manures must be kept in mind.

Time of Application

The time of year when manure should be applied to rubber is not regarded as of major importance, but it is advisable not to apply soluble manures or to broadcast insoluble ones too near the season of heavy rains. With soluble manures there is a danger of loss of nitrogen by leaching and this may be somewhat greater since the substitution of nitrate of soda for sulphate of ammonia. If bulky insoluble manures are broadcast too close to the monsoon there is a likelihood of considerable bodily movement away from the point of application.

As to whether manure is best applied before, during or after wintering, little experimental evidence is available. In theory, a time should be chosen when the plant food is most likely to be taken up by an active root system. In this connection it may be mentioned that under tropical conditions nitrogenous organic manures are converted to an available form much more quickly than under temperate conditions, and experiments at Peradeniya have shown that the maximum rate of nitrification occurs from 4 to 8 weeks after application. If it is considered suitable to apply the manure at a time when the tree is putting on new growth and the root system may be expected to be actively taking up nutrients, a case may be made for application in the February, March, April period.

Reference may be made to the view that it is better to make application before leaf-fall, so that the added manure is taken up at once by the tree and stored until required later to push forward the new season's growth. A theoretical objection may be raised to this on the grounds that if the nitrogen applied shortly before wintering is transported to the foliage, an early loss of part of this added nutrient may occur due to leaf-fall.

Until definite experimental evidence is available not only with reference to refoliation but also to yields, we hold the view that the differences resulting from variation in the time of application

are likely to be small in relation to the general effect of manures and that, provided the monsoon periods are avoided, the time chosen should be such as to fit in best with estate practice.

Method of Application

Another aspect that is probably of greater importance than the one just referred to, is the method of application. The ideal method is to apply the manure evenly to the area covered by the feeding roots, and this in the case of the interlaced root system of mature rubber means the whole area of the stand. With soluble manures (and where the cover is not too heavy) this could be achieved by simple broadcasting.

Where insoluble organic manures are employed, broadcasting is not advised owing to the danger of some of the manure being washed away bodily by heavy rain. Such manure should be forked into the soil and the method employed will depend on the lie of the land and the soil type. An area which does not allow easy penetration of water and which is steep should not be extensively forked owing to the danger of loss of the valuable top soil. In such a case the manure may be applied in alternate rows between the trees and the next application may be given in the remaining rows. Whatever be the method of application the object should be to get the insoluble manure incorporated with the soil but in such a way as to reduce the possibility of serious soil loss to a minimum.

An alternative is to apply the manure to shallow pits placed centrally between every four trees. The disadvantage here is that in order to avoid disturbing too large an area of soil the pits may be made so small that the manure is unduly concentrated and the maximum up-take by the tree may not be obtained.

Mention may also be made of a method that is being used in Borneo and for which a certain measure of success is being claimed. The manure is put down on a single tree basis by distributing in a circle round the bole.

One other aspect of the forking in of fertilisers is the danger of breaking the young roots. With careful forking, this may not result in serious damage to the tree, but soluble manures or manures readily changed to a soluble form should not be applied at a time

when there may be a possibility that the fine feeding roots have had their efficiency impaired.

Where phosphatic manures are concerned it is probably always advisable to get them incorporated with the soil not only because of the danger of bodily loss of relatively insoluble phosphates during heavy rains, but also because of the very slow penetration of phosphate into the soil. This could be achieved perhaps by forking the soil in early December when its moist condition would allow of easy working and the danger of erosion from subsequent rains would not be very great. The phosphatic manure, perhaps with added soluble nitrogen and potash, could then be broadcast in March-April. The monsoon rains would tend to wash the insoluble phosphate into the crevices of the broken soil surface.

The above suggestion may be useful on sloping land where the cover is thin, but where the cover is good this should offer sufficient obstruction to the sweeping away of insoluble manures by run-off water, and it is likely that some of the finely ground phosphate will find its way down old root channels and other interstices in the top soil.

It is not possible to lay down any hard and fast rule with respect to the controversy of forking *versus* broadcasting, but there does seem to be a need for trying to strike a balance between the advantages and disadvantages of both methods, and it is likely that the most suitable method of applying manures to old rubber will not be the same for all estates.

At Dartonfield this question is being investigated as a minor part of the manurial experiment on old rubber already referred to. Owing to the way in which the experiment has developed the comparison between forking in and broadcasting applies only to the added artificial manures, the cover being left undisturbed. Examination of the yield records for the past three years shows practically no difference between the two methods; for example, in 1939 the yield from the broadcast plots was 477 lbs. per acre and from the forked plots 475 lbs. per acre.

Conclusion

In conclusion it may be said that the most reliable method, at this stage of our knowledge, of investigating the manurial needs

of rubber is to appeal to the tree. This means a number of fairly extensive field trials requiring perhaps several years before any definite conclusions can be drawn.

In Ceylon few such trials have been carried out, and the recommendations of the Rubber Research Scheme are based largely on the experiences of local planters and the experimental results obtained in other countries, modified by the findings from a few local field trials.

From the above information a general manuring policy has been worked out embodying the biennial application of an inorganic nitrogenous manure, and in addition the application every fourth year of a moderate dose of phosphate and a smaller amount of potash.

Time of application is not regarded as of major importance, provided that the danger of loss of soluble manures during heavy rain is kept in mind.

Method of application is at present a point that can best be settled by a study of conditions on the estate concerned with attention given to past experience.

In all problems involving the manuring of mature rubber the future policy of the Company should be taken into account. The possibility that whilst a vegetative response may appear shortly after manuring, increase in yield may not become apparent for some years should always be kept in view.

THE INTERNATIONAL NOTATION FOR TAPPING SYSTEMS

(Revised Version : May, 1940)

(**Editor's Note.**—An account of the original version of the standard tapping notation was reproduced in the Combined Third and Fourth Quarterly Circulars for 1939, page 111. Subsequently certain amendments were suggested which are considered to improve the notation to an extent which offsets the obvious disadvantage of such an early revision. The revised notation is used in papers appearing in the present issue and will be employed in all future publications of the Research Scheme).

Summary

AT the Conference of Directors of Rubber Research Organisations, held in Kuala Lumpur last February, certain amendments and additions to the International Tapping Notation were considered, and particularly the suggestion of Mr. J. J. H. Cronshey and Mr. C. Barclay of the Plantation Research Department of the United States Rubber Plantations, Sumatra, that the notation would be simplified by reducing its basis to a single convention.

After discussion, it was decided to submit a revised version to each of the organisations concerned with the recommendation that it should be substituted for the original version (Communication No. 240, J.R.R.I.M., Vol. 9, 1939, p. 164 : also published in Archief voor de Rubbercultuur, Vol. 23, No. 4, 1939, p. 298 and in the Combined 3rd and 4th Quarterly Circulars for 1939 of the Rubber Research Scheme (Ceylon), Vol. 16, 1939, p. 111). The revised version which follows has now been formally approved by the Central Association of Experiment Stations in the Netherlands East Indies, the Rubber Research Scheme (Ceylon) and the Rubber Research Institute of Malaya, and will henceforth be used in place of the original in all publications of these organisations.

The Standard Notation (Revised, 1940)

The standard symbols to designate systems of tapping *Hevea* are now grouped as follows :—

(1) number, type and length of cuts tapped on a tree at each tapping,

(2) tapping periods and cycles (includes " frequency "),

(3) number of successive panels, period and cycle of change (only required for " change-over " systems),

and (4) relative intensity.

The basis of the notation is to state amount of tapping as fraction of daily tapping on a full-circumference. An average of a quarter-cut tapped per day is taken as standard (100%) in the estimation of relative intensity.

(1) Number, Type and Length of Cuts

To be expressed as a fraction :

(*a*) the *numerator* to consist of a capital letter designating the *type* of cut,

S = spiral,
V = V,
L = extended-V (left arm of V extended upwards to full circumference),
and C = circumference (when types of cut are mixed or unspecified),

with a figure indicating the *number*, if more than one cut is tapped on a tree at each tapping ;
and (*b*) the *denominator* to be the reciprocal of the fraction expressing the horizontal *length* of each cut in terms of the full circumference.

Examples :

$S/1$ = *one full-spiral cut*
$S/2$ = *one half-spiral cut*
$S/3$ = *one third-spiral cut*
$S/4$ = *one quarter-spiral cut*
$V/2$ = *one half-V cut*
$2V/2$ = *two half-V cuts*
$4V/2$ = *four half-V cuts*
$2S/4$ = *two quarter-spiral cuts*
$L/1$ = *one extended-V cut (full circumference)*
$C/1$ = *one full-circumference cut (unspecified type)*
$C/2$ = *one half-circumference cut (unspecified type)*
$2C/2$ = *two half-circumference cuts (unspecified type)*

(2) Tapping Periods and Cycles

To be expressed as a fraction or series of fractions, denoting "frequency" and/or "periodicity":

(*a*) the *numerator* of each fraction to denote the *period* of tapping and *unit*;

and (*b*) the *denominator* to denote the length of *cycle* (of tapping *plus rest*) reckoned in the same units.

Units to be indicated by small letters:

d = days,

w = weeks,

m = months

and y = years.

Examples:

d/1 = *daily*

d/2 = *alternate-daily* (*one day in two*)

d/3 = *third-daily* (*one day in three*)

d/4 = *fourth-daily* (*one day in four*)

2*d*/1 = *twice daily*

2*w* 4 = *two weeks in four* (*two weeks in tapping, followed by two weeks' rest*)

6*m* 9 = *six months in nine* (*six months in tapping, followed by three months' rest*)

m 2 = *alternate-monthly* (*one month in tapping, followed by one month's rest*)

0·5*m* 1 = *alternate half-monthly* (*half month in tapping, followed by half-month's rest*)

d 2,6*m* 9 = *alternate-daily for six months in nine* (*six months of alternate-daily tapping followed by three months' rest*)

d 1,*m* 2,12*m* 18 = *daily for one month in two during twelve months out of eighteen* (*daily alternate-monthly tapping for twelve months, followed by six months' rest*)

Note.—The distinction between "frequency" and "periodicity" has been eliminated in the revised notation by reducing the symbols to a common form. The denominator of the final fraction gives the full cyclic period of the system, whether "continuous" or "periodic."

(3) Number of Successive Panels, Period and Cycle of Change ("Change-over" Systems)

To be designated, when required by a fraction *in brackets*:

(*a*) the *numerator* to indicate the *number* of successive panels (first), multiplied by the *period* (tapping plus rest) between each change of panels,

and (*b*) the *denominator* to indicate the *cycle* of panel rotation.

Examples:

(2×2*d*/4) = *two panels, each in tapping for two days alternately* (*panel-cycle of four days*)

(2×16*w*/32) = *two panels, each in tapping for sixteen weeks alternately* (*panel-cycle of thirty-two weeks*)

(3×9*m*/27) = *three panels, each in tapping for nine months in rotation* (*panel-cycle of twenty-seven months*)

Note.—(1) The numerical part inside the brackets always reduces to unity and so does not affect the calculation of relative intensity.

(2) Change-over symbols should be inserted after the fraction for tapping period and cycle to which they logically belong. For example, d/2(2×2d/4),6m/9 would designate alternate-daily tapping on alternate panels for six months followed by three months' rest, whereas d/2,6m/9 (2×9m/18) would designate alternate-daily tapping for six months out of nine, with the six-monthly tapping periods on alternate panels.

(4) Relative Intensity

To be expressed as *percentage* of intensity on the *standard system*, *half-spiral*, *alternate-daily tapping* (S/2,d/2,100%): that is the equivalent of a half-cut tapped on half the area—or an average of a quarter-cut per tree—on all days when there is tapping.

To calculate relative intensity multiply out the fractions in the formula (ignoring alphabetical symbols) and then multiply the product by 400.

Examples:

S/2,*d*/2.....$\frac{1}{2}\times\frac{1}{2}=\frac{1}{4}$; *multiplied by* 400=100%.
(The product on the standard system is $\frac{1}{4}$, hence multiplication by 400 is required to express as percentage)

2*V*/2,*d*/3,5*m*/10.....$\frac{2}{2}\times\frac{1}{3}\times\frac{5}{10}=\frac{1}{6}$; *multiplied by* 400=67%
(A "Sunderland" system: double-cut, third-daily, periodic tapping).

S/2,*d*/1,*m*/2,12*m*/18.....$\frac{1}{2}\times\frac{1}{1}\times\frac{1}{2}\times\frac{12}{18}=\frac{1}{6}$; *multiplied by* 400=67%.
(A periodic system used in Sumatra).

S/3,*d*/1,40*d*/80 (3×80*d*/240).....$\frac{1}{3}\times\frac{1}{1}\times\frac{40}{80}\times(\frac{240}{240})=\frac{1}{6}$; *multiplied by* 400 = 67%.
(A periodic change-over system with three successive panels)

Some Examples of the Full Notation

Below are given the revised formulae for the twelve examples on pp. 167-168 of Communication No. 240, followed by the seven examples of change-over systems on p. 169 and one new example :—

(1) V/2,d/2,100% = a half-V cut tapped alternate-daily.

(2) S/3,d/2,67% = a third -spiral cut tapped alternate-daily.

(3) S/2,d/2,12m/18,67% = a half-spiral cut tapped alternate-daily for twelve months in eighteen (twelve months in tapping followed by six months' rest).

(4) S/3,d/1,40d/60,89% = a third-spiral cut tapped daily for forty days in sixty (forty days in tapping followed by twenty days' rest).

(5) S/2,d/3,12m/16,50% = a half-spiral cut tapped every third day for twelve months in sixteen (twelve months in tapping followed by four months' rest).

(6) 2S/2,d/4,100% = two half-spiral cuts tapped every fourth day.

(7) 2V/2,d/3,5m/10,67% = two half-V cuts tapped every third day for five months in ten (five months in tapping followed by five months' rest).

(8) 2V/2,d/3,15w/25,80% = two half-V cuts tapped every third day for fifteen weeks in twenty-five (fifteen weeks in tapping followed by ten weeks' rest).

(9) S/1,d/3,3m/4,100% = a full-spiral cut tapped every third day for three months in four (three months in tapping followed by one month's rest).

(10) L/1,d/4,100% = a full-circumference extended-V cut tapped every fourth day.

(11) S/2,d/1,m/2,12m/18,67% = a half-spiral cut tapped daily in alternate months for twelve months in eighteen (twelve months of daily-alternate monthly tapping followed by six months' rest).

(12) 4V/2,d/2,400% = four half-V cuts tapped alternate daily.

(13) S/2,d/2(2×6m/12),100% = a half-spiral cut tapped alternate-daily with six months out of twelve on each of two alternate panels.

(14) S/2,d/2(2×2d/4),100% = a half-spiral cut tapped alternate-daily, with two days out of four on alternate panels (alternate tappings on alternate panels).

(15) S/3,d/2(3×6m/18),67% = a third-spiral cut tapped alternate-daily, with six months out of eighteen on each of three panels in rotation.

(16) S/2,d(2×2d/4)6m/9,67% = a half-spiral cut tapped alternate-daily, with two days out of four on alternate panels, for six months out of nine (alternate tappings on alternate panels for six months followed by three months' rest).

(17) S/2,d/2,6m/9(2×9m/18),67% = a half-spiral cut tapped alternate-daily for six months in nine, with nine months out of eighteen on alternate panels (six months in tapping followed by three months' rest on each of two alternate panels).

(18) S/2,d/1,2w/4(2×4w/8),100% = a half-spiral cut tapped daily for two weeks in four, with four weeks out of eight on alternate panels (two weeks in tapping followed by two weeks' rest on each of two alternate panels).

(19) 2S/2,d/2(2×2d),200% = double-cut change-over system: continuous alternate-daily tapping on two half-spiral cuts on the trees, but with alternate tappings on two pairs of alternating cuts—that is a system with four cuts on the trees of which only two are tapped at a time, such as is sometimes used in slaughter tapping.

(20) C/1,d/3,4m/6,89% = a full-circumference cut (of unspecified type) tapped third-daily for four months in six (four months in tapping followed by two months' rest).

Some Amplifications of the Notation

Multiple-cut Systems

Where it is particularly desired to indicate the position of the cuts in a double-cut or multiple-cut system, the fractions denoting

individual cuts can be written in full, using the following conventional signs :—

// = cuts in echelon on adjacent panels,

+ = cuts on opposite sides of the tree,

and — = cuts superimposed one above the other on the same panel.

Examples :

S/4//*S*/4/,*d*/2,100% = *two quarter-spiral cuts in echelon, both tapped alternate-daily.* (*This could be simplified to* 2*S*/4,*d*/2).

S/4+*S*/4,*d*/2,100% = *two quarter-spiral cuts on opposite panels, tapped alternate-daily.* (*Also*=2*S*/4,*d*/2)

V/2—*V*/2,*d*/2,200% = *two half-V superimposed cuts both tapped alternate-daily* (= 2*V*/2,*d*/2—*a form of slaughter tapping*).

V/2—*V*/2+*V*/2—*V*/2,*d*/2,400% = *four half-V cuts* (*two superimposed on each of the two opposite panels*), *all tapped alternate-daily* (=4*V*/2,*d*/2 —*a more drastic form of slaughter tapping*).

Note.—In calculating relative intensity, the fractions separated by the conventional symbols //, + or — must be *added* together and the *sum* multiplied by the other fractions of the formula (frequency, periodicity, etc.) ; the same result will then be obtained as if the simplified formula (in brackets above) is used in the calculation. (The symbols are conventional : they should *not* be interpreted as the mathematical signs plus and minus).

Amount of Tapping

The amount of tapping in a given period may be reckoned as the product of length of cut by number of tappings, expressed in *circumference units* (circs.).

Examples :

85 *taps on full-circumf.* (340·0 *quarter-cuts*)	= 85·0 *circs.*
167 *taps on half-circumf.* (334·0 *quarter-cuts*)	= 83·5 „
167 *taps on third-circum.* (222·7) *quarter-cuts*)	= 55·7 „
324 *taps on quarter-circ.* (324·0 *quarter-cuts*)	= 81·0 „

Note.—(1) Amount of tapping is expressed in full-circumference units, but it is convenient also to reckon the number of quarter-cuts for estimation of the *rate* of tapping (intensity). On this scale the system selected as standard (S/2,*d*/2,100%) realises an average of one quarter-cut per day.

(2) Calculation of amount of tapping on commercial areas should be based on *average* number of tappings *per tree*, so as to correct for vacant tasks. Average number of tappings may be determined over any given period by dividing total tapper-days by total number of tasks *overall* (that is inclusive of tasks in resting areas as well as those in tapping).

Potential Intensity

Potential intensity is the maximum daily *rate of tapping* produced by a system, when there is tapping every day.

The potential intensity of the system arbitrarily selected as standard (= 100%, *vide* sect. (4), p. 242) is a daily tapping *rate of one quarter-cut per day*.

Actual Intensity

Actual intensity is the *amount* of tapping actually *realised per day*. It falls short of the potential intensity of the system by reason of days lost through weather, holidays, etc.

The tapping formula may be amplified, if desired, to describe past performance by appending either the number of units tapped or the actual intensity realised over a given period.

For example, when tabulating results from a year's tapping (365 days) on the half-spiral alternate-daily system, with an average of 167·3 tappings per tree, the following amplified formula could be recorded:

S/2,d/2,100% (0·92 quarter-cuts per day = 83·65 circs.)

The first figure within the bracket allows ready comparison between the actual rate of tapping (0·92) and the potential rate of the system —since the relative intensity expresses potential intensity in the form of a percentage (1·00 quarter-cuts per day = 100%). The final figure states the actual amount of tapping over the given period.

Note.—To calculate actual intensity (in quarter-cuts per day) multiply four times the *length of cut* in the formula by the *average number of tappings* per tree and divided by the *total number of days* in the given period (*e.g.* in the above example $4 \times \frac{1}{2} \times 167{\cdot}3 \div 365 = 0{\cdot}92$).

Height of Tapping and Bark Consumption

Height of tapping and bark consumption may, when required, be appended to the formula, preceded by the symbol h, in the form described on page 155 of Communication No. 239 (J.R.R.I.M., Vol. 9, 1939).

MEETINGS

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the fifty-first meeting of the Rubber Research Board held in the Chamber of Commerce Building, Colombo, at 10 a.m. on Wednesday, 20th March, 1940.

Present: Mr. E. Rodrigo, C.C.S. (in the chair), Mr. C. H. Collins, C.C.S. (Deputy Financial Secretary), Mr. T. Amarasuriya, Mr. W. P. H. Dias, J.P., Mr. L. B. de Mel, J.P., U.M., Mr. G. E. de Silva, M.S.C., Mr. T. C. A. de Soysa, Mr. L. P. Gapp, Mr. F. H. Griffith, M.S.C., Mr. R. J. Hartley, Mr. J. C. Kelly, Mr. F. A. Obeyesekere, Mr. B. M. Selwyn, Mr. N. D. S. Silva, O.B.E., J.P., and Mr. E. W. Whitelaw.

Mr. R. K. S. Murray, Acting Director, was also present by invitation.

1. Minutes

Draft minutes of the meeting held on 18th January, 1940, were confirmed and signed by the Chairman.

2. Board

(*a*) The Chairman reported that Mr. L. P. Gapp had resumed membership as a nominee of the Ceylon Estates Proprietary Association from 8th November, 1939, relieving Mr. A. W. Harrison. The latter was thanked for his services.

(*b*) The Chairman also welcomed Mr. R. J. Hartley who had been nominated by the Rubber Growers' Association to act for Mr. I. L. Cameron with effect from 7th February, 1940.

3. Experimental Committee

Recommendations made at meeting held on 28th February, 1940.

(*a*) *Supplementary Votes* were passed as follows:—

Dartonfield Normal Working	Rs. 479·27
Pinnagoda Budwood Nursery	,, 451·73

(*b*) *Establishment of Seed Gardens.*—Decided that a letter be addressed to the Ceylon Estates Proprietary Association and Low-country Products Association asking whether any of their members would undertake to establish seed gardens on their estates with the clones being used in the artificial pollination experiments on the basis of the terms outlined in the memorandum presented.

(*c*) *Bungalow for Geneticist.*—Decided that a bungalow should not be built at present.

4. Provident Fund

The report of the Provident Fund Committee was fully considered, and it was decided :—

(1) That the rates of contribution to the Provident Fund for all members and for the Board's bonus be raised to 7½% as from 1st April, 1940, and that the question of a 10% rate be reviewed six months after the termination of war unless it has been reconsidered in the meantime.

(2) That the rate of interest payable by the Board be considered at the next meeting after certain enquiries had been made.

(3) That rule 3 (1) of the Provident Fund rules be altered to read as follows : " On the last day of the Board's financial year there shall be placed to the credit of each member a bonus equal to the sum contributed by such member during that year."

5. Accounts

(*a*) *Statement of Receipts and Payments of the Board for the quarter ended 31st December, 1939 (C.P. 829)*, was adopted.

(*b*) *Dartonfield and Nivitigalakele accounts for October, November and December, 1939*, were tabled.

(*c*) *Balance Sheet and Auditor's Report for 1939* was adopted.

The following figures summarise the financial position :—

Income, 1939		Rs. 214,738
Expenditure, 1939 :		
Revenue	Rs. 194,298	
Capital	„ 21,115	„ 215,413
Available Cash Balance		„ 133,624

The Chairman undertook to give careful consideration to any proposals for additional research which the financial position of the Scheme might permit.

(*d*) *Statement of Excesses and Savings on Votes for 1939.*—Supplementary votes were passed to cover excesses and it was noted that over-expenditure was covered by savings under other votes.

(*e*) *Revote for 1940.*—Rs. 1,211 representing the unspent balance of the capital vote of Rs. 1,912 for Water and Power Scheme was re-voted for 1940.

(*f*) *Inventory Report for 1939* was adopted.

(*g*) *Investment of Rs. 20,000 in Ceylon Government 3¼% Loan, 1949/51.*—The Chairman reported that he proposed to tender for the allocation of Rs. 20,000 in this loan, and this was approved.

(*h*) *Fixed Deposit.*—The renewal of a fixed deposit of Rs. 30,000 at the Chartered Bank of India, Australia & China at 1¾% interest per annum was approved.

6. Reports

(*a*) *Technical Officers' Progress Reports for the 4th Quarter, 1939*, were adopted.

(*b*) *Annual Report for 1939* was adopted subject to a minor alteration.

A suggestion that these reports were unnecessarily long was considered, but it was decided that as the Annual Report was subsequently published and was a useful medium for presenting data which might not otherwise appear in print it should be as fully informative as possible. The Experimental Committee, however, was asked to consider and report on the desirability of reducing the volume of the Quarterly Reports.

7. Staff

The appointment of Mr. R. K. S. Murray, Botanist and Mycologist, to act for the Director during the latter's absence in Malaya and on long furlough was confirmed.

8. Rubber Conference and Field Day

The Chairman reported that an invitation from the Chairman of the Rubber Conference Committee had been circulated to members and the Director had accepted on their behalf. He also proposed to hold a special Visitors' Day at Dartonfield on the day following the Conference (20th April). This was approved.

9. Smallholdings Department

The purchase of a Sinhalese typewriter at a cost of Rs. 425 was approved.

10. Publications

The 3rd and 4th Combined Quarterly Circular for 1939 was tabled.

Research Laboratories,
Dartonfield, Agalawatta,
11th April, 1940.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the fifty-second meeting of the Rubber Research Board held in the Board Room of the Ceylon Chamber of Commerce, at 2.30 p.m. on Monday, 10th June, 1940.

Present: Mr. E. Rodrigo, C.C.S. (in the chair), Mr. C. H. Collins, C.C.S. (Acting Financial Secretary), Mr. T. Amarasuriya, Mr. G. E. de Silva, M.S.C., Mr. W. P. H. Dias, J.P., Mr. L. M. M. Dias, Mr. L. P. Gapp, Mr. R. J. Hartley, Mr. R. C. Kannangara, M.S.C., Mr. F. A. Obeyesekere, Mr. B. M. Selwyn, Mr. E. W. Whitelaw and Mr. E. C. Villiers, M.S.C.

Mr. R. K. S. Murray, Acting Director, was present by invitation.

Apology for absence was received from Mr. F. H. Griffith, M.S.C.

1. Minutes

(*a*) Draft minutes of the meeting held on 20th March, 1940, were confirmed and signed by the Chairman.

(*b*) Matters arising from the minutes—

(1) *Cash Reserve.*—It was agreed that a special cash reserve was unnecessary in view of the existence of the Depreciation Reserve of about Rs. 94,000.

(2) *Provident Fund.*—It was decided that the Staff Provident Fund should, in future, be administered as a separate fund by a Board of Trustees consisting of the Chairman of the Board, the Director, the Financial Secretary or person deputed by him and one other member of the Board. Mr. R. J. Hartley was nominated to serve on the Board.

2. Board

(*a*) *Rènomination of Mr. I. L. Cameron.*—The Chairman reported that Mr. I. L. Cameron had been re-nominated by the Rubber Growers' Association to serve on the Board for a further period of three years from 15th April, 1940.

(*b*) *Nomination of Mr. L. M. M. Dias.*—The Chairman welcomed to the Board Mr. L. M. M. Dias who had been nominated by the Low-country Products Association in place of Mr. L. B. de Mel, J.P., U.M., with effect from 12th April, 1940. Mr. de Mel was thanked for his services.

3. Experimental Committee

Recommendations made at meeting held on 27th April, 1940 :—

(*a*) *Visiting Agent's Report.*—The Visiting Agent's Report on his inspection of Dartonfield and Nivitigalakele on 24th November, 1939, was adopted, and the recommendation to pass a supplementary vote of Rs. 1,225 for plastering line rooms was approved.

(*b*) *Visiting Engineer's Report.*—The Visiting Engineer's Report on his inspection on the 7th and 8th February, 1940, was adopted.

(*c*) *War Bonus and Issue Price of Rice.*—It was agreed that the recommendations of the Kalutara Planters' Association as regards the payment of a War Bonus to estate labourers and adjustment of the issue price of rice should be followed at the discretion of the Director and Estate Superintendent.

(*d*) *Recruiting Labour.*—A supplementary vote of Rs. 60 was passed to cover expenses in recruiting temporary labour.

(*e*) *Quarterly Reports.*—It was agreed that the officers' Quarterly Progress Reports should not be curtailed, but that in the interests of paper economy their circulation should be reduced by sending only the Director's Report to members of the Board, London Advisory Committee, etc.

(*f*) *Memorandum by Dr. H. A. Tempany.*—A memorandum, outlining a scheme for the establishment of a system of certification for rubber of a guaranteed standard of cleanliness, was considered. It was agreed that a scheme whereby a manufacturer could obtain specially clean rubber was desirable, but that it was not at present clear how the scheme would be financed or whether there would be any direct profit to the producer of such "standard mark" rubber. It was for the producing interests themselves to set up such an organisation, the function of the Board being merely to advise on equipment and methods of manufacture. It was agreed that a reply should be sent to the London Advisory Committee in the terms of a draft prepared by the Chemist.

(*g*) *Nomination to the London Advisory Committee.*—It was agreed that Mr. B. M. Selwyn's name be suggested to the Rubber Growers' Association for nomination to the London Advisory Committee as representing Ceylon planting interests when a vacancy next occurs.

4. Smallholdings Committee

The minutes of a meeting of the Smallholdings Committee held on 3rd May, 1940, were adopted.

5. Accounts

(*a*) *Statement of Receipts and Payments of the Board for the quarter ending 31st March, 1940* (*C.P., 858*) was approved.

(*b*) *Statement of Receipts and Payments of the London Advisory Committee for the year ending 31st December, 1939* (*C.P., 847*) was approved.

(*c*) *Dartonfield and Nivitigalakele Accounts for January and February, 1940,* were tabled.

(*d*) *Fixed Deposit.*—The Chairman reported that a fixed deposit of Rs. 15,000 at the Imperial Bank of India was transferred to the Bank of Ceylon for 12 months at $1\frac{3}{4}\%$ from 10th April, 1940, the rate of interest offered by the Imperial Bank for renewal being only $1\frac{1}{2}\%$.

(*e*) *Investment of Funds in Ceylon Government* $3\frac{1}{4}\%$ *Loan.*—Agreed that Rs. 30,000 stock be purchased in the above loan.

(*f*) *Supplementary Vote.*—A supplementary vote of Rs. 750 was passed to cover over-expenditure incurred as a result of the Board's recent decisions to increase the insured values of buildings and to insure against the risks of riot and civil commotion and liability for accidents to senior staff.

6. Staff

(*a*) *Release of Staff for War Service.*—It was decided that any officer, except the Director or the officer officiating as such, might be released for war service on the following terms :—

(1) Full salary will be paid until the officer is accepted for service subject to a maximum of five months from the date of leaving Ceylon.

(2) If the officer is not accepted for service within this period he must return to Ceylon, his passage being paid by the Board.

(3) If the officer's military salary is less than his civil salary the difference will be paid by the Board during the period of his mobilisation.

(4) The officer's post will be kept open for him until he is demobilised.

(5) The Board's contributions to the Provident Fund during the period of mobilisation will be on the basis of full salary, the officer's contribution being based on the balance salary actually received from the Board.

(6) The officer's application should be accompanied by a medical certificate stating that he is fit for military duty.

(*b*) *Junior Staff Contributions to the Gloucester Fund.*—The Chairman reported that at a meeting of the Junior Staff Association the junior staff had unanimously decided to contribute 1% of their monthly salaries to the Gloucester Fund, and had requested that the amounts be deducted on the pay sheet each month. It was decided that although the junior staff should be congratulated on their gesture the deduction from the pay sheets would be an undesirable procedure and could not be approved.

7. Rubber Conference

Agreed to increase the Board's contribution towards the expenses of the Rubber Conference from Rs. 100 (already voted) to Rs. 184·60.

8. London Advisory Committee for Rubber Research (Ceylon and Malaya)

Minutes of meetings of the Committee and the Technical Sub-Committee held on the 26th January, 1940, were adopted.

9. Publications

The first Quarterly Circular for 1940 was tabled.

10. New Rubber Planting Scheme

A letter from the Chief Advisory Officer of the New Rubber Planting Scheme, stating that Government had approved of 900 copies of the "Handbook of Rubber Planting (Ceylon)" being supplied free of charge to the Scheme and expressing his gratitude to the staff of the Research Scheme for their assistance and co-operation, was read and noted with appreciation.

11. Mr. B. M. Selwyn

In view of Mr. Selwyn's impending departure on retirement the Chairman said he wished to express, on behalf of the Board, their appreciation of his active and valuable services to the Board.

Research Laboratories,
Dartonfield, Agalawatta,
9th July, 1940.

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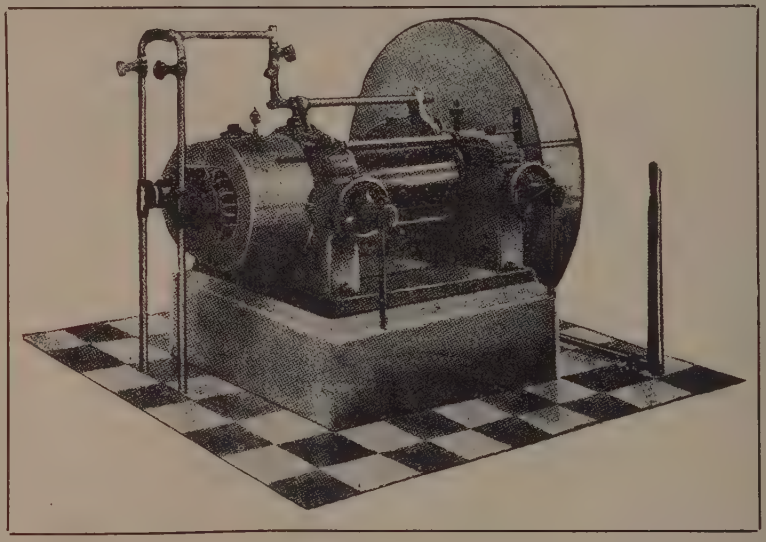

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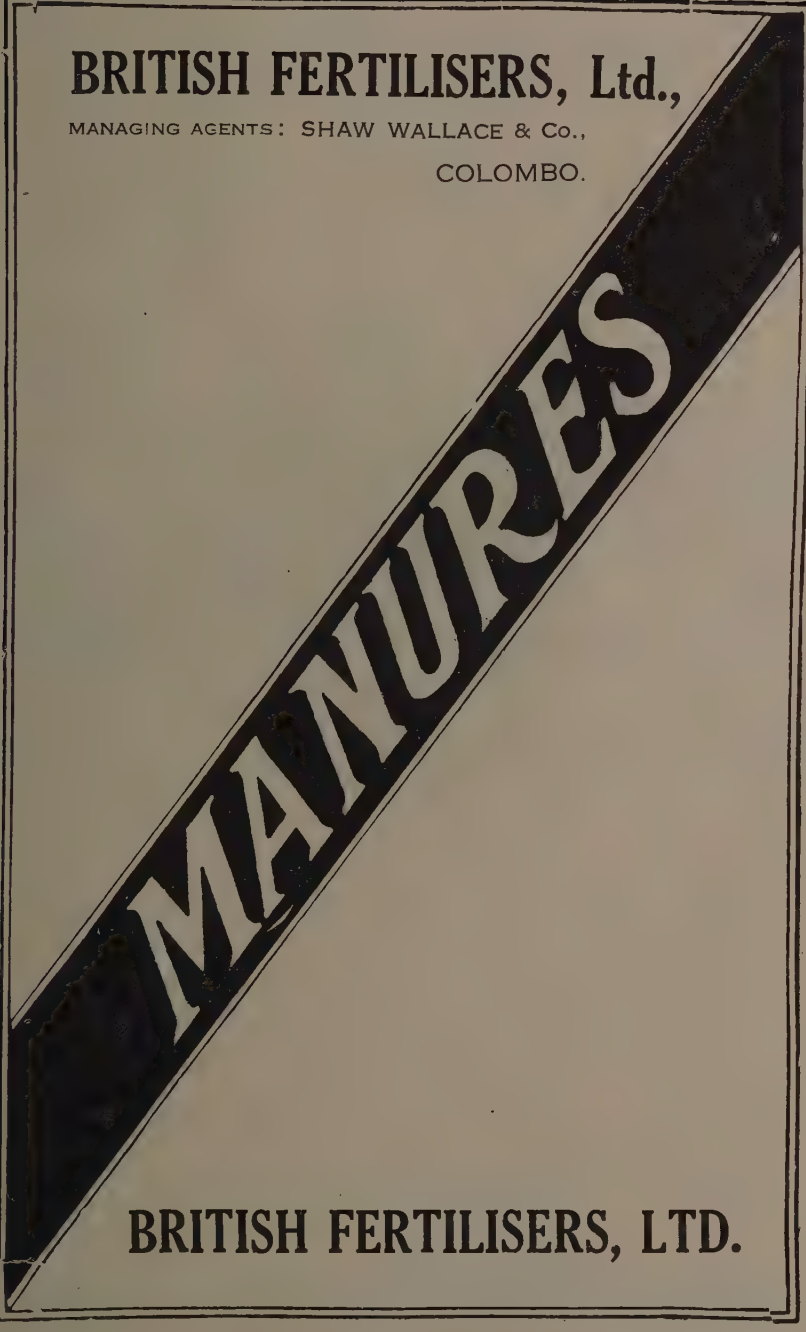

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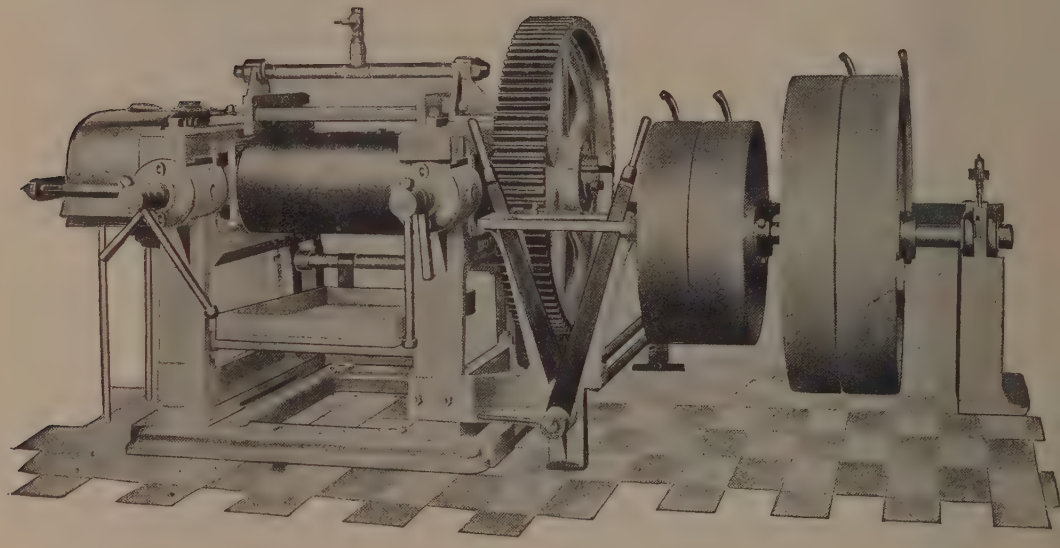

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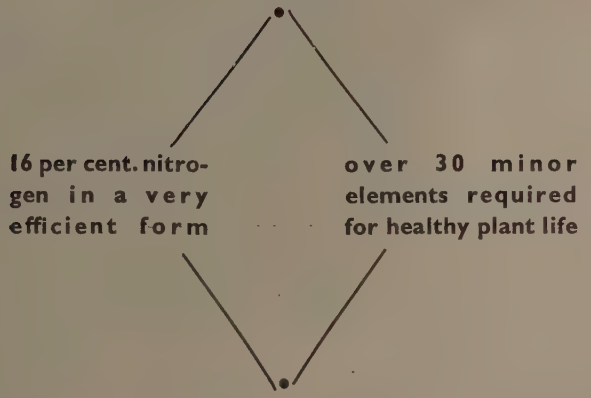

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Sir Frank Stockdale, K.C.M.G., C.B.E.

Member nominated by the Government of Ceylon:

VACANT

Member nominated by the Governments in British Malaya:

Mr. J. Lornie, C.M.G.

Members representing Malayan Planting interests—nominated by the Rubber Growers' Association:

Mr. P. J. Burgess (Chairman).
Mr. J. L. Milne.
Mr. Eric Macfadyen.

Members representing Ceylon Planting interests—nominated by the Rubber Growers' Association:

Sir Herbert Wright.
Mr. G. H. Masefield.
Mr. George Brown.

Member representing Manufacturing interests:

Lieutenant-Colonel J. Sealy-Clarke.

Ex-Officio Members:

Sir H. A. F. Lindsay, K.C.I.E., C.B.E., Director of the Imperial Institute.
Professor V. H. Blackman, Director of the Botanical Laboratories, Imperial College of Science and Technology.
Dr. S. P. Wiltshire, Director of the Imperial Mycological Institute.
Sir John Russell, O.B.E., Director of the Rothamsted Experimental Station.

Secretary:

Mr. J. A. Nelson, B.Sc.

The Technical Sub-Committee consists of members of the Advisory Committee with the following co-opted Members:

Mr. G. Martin (Superintendent of Rubber Investigations).
Mr. G. E. Coombs.
Mr. G. G. Balazs.
Mr. B. D. Porritt.
Mr. H. N. Ridley
Mr. W. C. Smith
Dr. H. P. Stevens
Dr. D. F. Twiss
Prof. R. G. H. Clements

STAFF.

Mr. G. Martin, B.Sc., A.I.C., F.I.R.I.
Mr. H. C. Baker, M.Sc., A.I.C., A.I.R.I.

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